Automotive War Production

AUTOMOTIVE WAR PRODUCTION

Formerly AUTOMOBILE FACTS

Vol. 1 No. 1 Published for the automotive industry by the Automobile Manufacturers Association March 3, 1942

Motor Industry's War Load Dwarfs All Previous Production Records

On the site of yesterday's assembly lines a war industry grows.

THE WAR LOAD of the automotive industry is a production job at least twice as big, measured by manpower, and three times as big, on a dollar basis, as the industry's 1941 civilian production.

It will reach, on the basis of present computations, a rate of $12,000,000,000 a year. This will call for "farming out," or sub-contracting pieces and operations, on a greater scale than ever before.

And although yesterday's assembly lines are in a turmoil of demolition and reconstruction, war production is advancing at so great a rate that some companies expect to have as many men and women at work in June as were employed in the last month before the outbreak of war.

With pre-Pearl Harbor war orders now doubled, tripled and quadrupled, existing war plants are undergoing rapid expansion to meet the new loads. In other plants, with all passenger car and light truck production stopped by the government, automotive conveyors have been ripped out, machines uprooted and floors swept clean for conversion of the space to war use.

Characteristic of the times, the yards outside the automobile plants today are filled with huge single-purpose tools, moved into vacant property to make way for specialized war production equipment, different from that used in car manufacture.

In the five weeks after Pearl Harbor, the War Department alone contracted for $3,500,000,000 worth of military supplies from automobile plants, a total that equaled the volume of all defense contracts given the industry in the first two years after the Nazi invasion of Poland.

Placement of orders doesn't mean production. But it does allow the plants to go ahead with the tooling—the rebuilding of old machine tools, the ordering of new ones, the making of dies, jigs, fixtures and gauges—for individual and specific jobs.

The effort is demanding the maximum energies of technical staffs, who are charged with arranging fabrication and flow of materials at the greatest rate in the industry's history.

When automobile production was in high gear, parts and materials flowed into assembly lines at the rate of a million dollars an hour. But the materials flow in the war production program will be much greater than ever before. It will be roughly equivalent to producing 15,000,000 cars and trucks in one year. (In 1929, the record year, 5,358,000 motor vehicles were produced.)

When running at full capacity on their present war orders, three of the biggest automobile companies will be producing at two and a half times the dollar volume rate they did in their peak month of 1941. Automotive companies generally will double at least their 1941 production volume.

(Continued on Page 2)

TO OUR READERS

AUTOMOTIVE WAR PRODUCTION is a new bulletin which takes the place of AUTOMOBILE FACTS, a publication you used to receive monthly.

Traditionally, the motor vehicle manufacturers have made available all the pertinent facts about their industry. But now civilian production of cars and trucks is halted, and on the production front there are no more "automobile facts." The automotive industry is a war industry.

While war necessarily restricts publication of much data, it is still possible, on an industry basis, to report many basic facts about the job the industry is doing for the fighting forces of our country and its allies.

AUTOMOTIVE WAR PRODUCTION is released with that purpose in view, on behalf of the makers of motor vehicles, bodies, parts, tools and dies, and other automotive products, all of whom are engaged in the war production effort.

AUTOMOTIVE WAR PRODUCTION will be published periodically, in a more flexible format than the monthly publication it replaces. It will be sent to interested persons who request it, and contents may be quoted. As in the past, prints or mats of illustrations for republication will be supplied upon request.

Competition Forgotten, Automotive Plants Work Together to Expedite War Production

MANUFACTURERS in the automotive industry, once the most keenly competitive business in America, are now joined cooperatively in a giant war industry, working to outproduce the Axis.

They are pooling experiences, exchanging technical information and supplying each other with parts and facilities, to the end that every usable resource in the entire industry is put to work in the shortest time possible on the war production job.

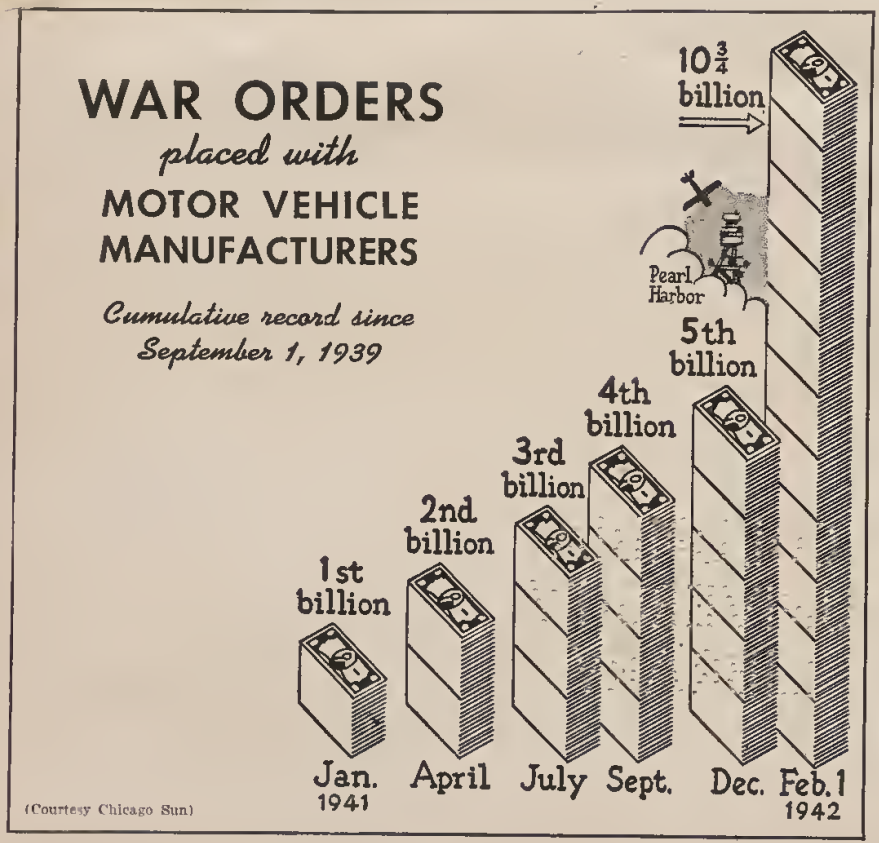
Organized direction is given to the effort through the Automotive Council for War Production, which was established shortly after hostilities began in the Pacific with the sole objective of expediting to the utmost the industry's war work.

Joined together in this common purpose are the firms which formerly manufactured passenger cars and trucks, bodies, automotive tools and dies, parts, bodies and accessories. They now have assignments to build 50 per cent of all the aircraft engines, 54 per cent of the machine guns, 91 per cent of the tanks and tank parts, 100 per cent of the motorized units, and many other items of equipment in the nation's war program.

The precedent for helping one another was established by the automotive companies during the defense period. But with the tremendous increase in war orders following Pearl Harbor, this cooperation was intensified.

To expedite the re-tooling of plants, the Automotive Council for War Production undertook to bridge the gap between companies looking for machines and machines looking for work. All firms in the industry are now listing their machine tools and similar equipment, with the Council acting as an industry-wide clearing house for information needed to effect sale or lease of equipment between individual companies. The Council also is carrying on a program to alleviate the tooling bottleneck, by reporting on available tool room capacity and by helping companies with war work locate tool-making facilities.

To facilitate war production, the Council has set up operating divisions of companies engaged in similar war work. Through the divisions, the companies are pooling their information on methods of production, in order to gain the best results in the shortest time. Another branch of the Council, a contract information service, has distributed shopping lists describing specific items which a contractor wishes to farm out. A complementing report gives firms seeking sub-contracts an opportunity to describe the character of work they can handle and the facilities available for performing it.



(Courtesy Chicago Sun)

Employment to Double In Automotive Industry

MORE THAN a million workers are expected to be employed in the automotive industry's war plants before the end of this year. This would compare with 543,000 on the payrolls in June, 1941, the recent high point.

Previous employment peaks in automotive manufacturing concerns generally are expected to be doubled when the plants reach full war production.

One company revealed that it would employ 148,000 war workers in March of this year, 185,000 in June, and 235,000 in September, reaching in that month the company's previous employment peak. By December the company estimates there will be 272,000 workers on its payrolls, and, by June, 1943, some 325,000. A top of 410,000 in its plants is looked for eventually.

Another company estimates its war production employment will be 200,000, double its former peak employment. Still another manufacturer, with a former employment level of 65,000, will have 130,000 on its production payrolls.

One bomber plant alone is expected to employ 100,000 persons, of which 25,000 probably will be women.

Industry's War Load

(Continued from Page 1)

Following a practice developed over the past forty years, the industry will farm out a big share of its work to suppliers. In normal times these subcontracting firms have been responsible for two billion dollars out of every three billion dollars' worth of finished products rolling off the assembly line. In the war job, sub-contractors are expected to handle at least $8,000,000,000 of the automotive industry's annual war volume.

Industry Steps Up Training of Workers

Expanded Programs Help Alleviate the Problem

BOTH IN SCOPE and enrollment, the current expansion of the automotive industry's training programs under the impact of war is supplying proof that America's famous productive ability is compounded of not just "hands," but primarily of "heads."

One company, whose peacetime training program had expanded in a quarter-century into facilities for the training of 5,000 students a year, was training 8,000 at the beginning of 1941 and now has expanded to classroom and on-the-job training of 12,000.

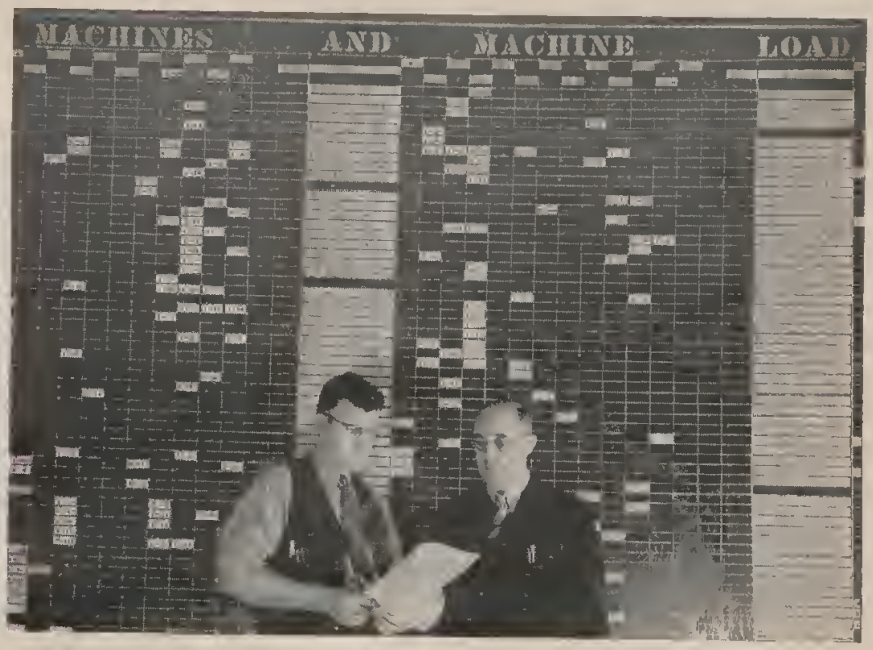
Another company, possessing an educational system that had provided 200-odd different courses to more than 75,000 student-workers since 1919, was busily overhauling its entire training operations at the end of 1940 with the aim of converting former students into teachers, and increased its teaching staff more than 30 per cent by the first part of 1942.

Similarly overhauling a group of training programs launched originally in 1933, another company called its 2,500 foremen into classrooms in 1941. It gave intensive courses to improve the men as supervisors and fit them as teachers, and then streamlined these courses to prepare almost a thousand hourly-rate workers for supervisory positions in war production operations.

As in the past, the industry's training facilities embrace a number of diversified and distinctly different programs, but the new necessities of war manufacture have wrought great changes. While the problem of retraining thousands of men and women for war jobs will be a great concern, the running start already made in this direction will help immeasurably.

The educational structures had been built on such solid foundations of experience that, in scores of instances, public and private schools, engulfed by unprecedented demands for more skilled workers than they could supply, called upon the industry's schools for teachers, textbooks and equipment.

In addition to the work of training supervisory and working personnel in increasing numbers for its own expanding war operations, the industry has provided special courses for several thousand members of the armed forces.



Master Board in War Plant Charts Fullest Use of Machine Tool Time

THE UNCEASING flow of parts, moving from machine to machine, is to the shop superintendent what the perfect blending of several hundred instruments is to the symphony conductor.

How to keep each machine functioning most effectively in relation to the scheduled output presents a problem, particularly in a big war plant where acres of machine tools extend out through the factory.

One automotive concern, now in its third year of turning out aircraft parts, has set up a board listing 750 machines occupied with war work.

Resembling a board found in a stock broker's office, the large production chart lists the 250 different types of tools, the number available of each type, their position in the plant, and the total number of hours each one is in operation per day.

By a glance at the board it is possible to determine the distribution of the machines in the 13 departments involved and the total loads imposed on all the types of machines.

Thus, if operations of a certain kind create a demand for more machine-hours than are available, the time figures for machines working at peak loads, posted in red, signal a warning that some other machines may have to be allotted part of the task.

The board has proved its usefulness in many ways. Potential machine bottlenecks are spotted before they develop. Master mechanics are able to prepare for shortages of hard-to-get machine tools by converting other machines to tasks for which they were not designed.

Companies Aid Each Other In Drive for War Output

TO SPEED procurement of Army scout cars and other military vehicles, three motor truck companies have pooled their purchasing facilities so as to build completely standardized equipment and make parts interchangeable.

The million-dollar proving ground of one motor company has been turned over to another for the testing of trucks and tanks.

One company which has been producing tanks for months has given representatives of other companies "the run of the plant" to acquaint them with practices that may be helpful in their own programs.

A group of thread mills in one corporation are working 'round the clock on machine parts for its peacetime rival.

Anti-aircraft gun parts go direct to one company's arsenal from the production lines of another making the same gun. These are just a few of the many examples of the inter-company cooperation on war work in the industry.

AUTOMOTIVE WAR PRODUCTION

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Short-Cuts Prevail on Production Jobs

Improved Techniques Save Time, Materials

Faced with a task of getting out war production in volume, the automotive industry is relying on improved manufacturing methods to short-cut time-consuming processes.

One of the automotive processes to be adopted is centrifugal casting or "liquid forging," which is the molding of mechanical parts from molten metal. This replaces the traditional forgings, made by hammering heated metal into shape.

The centrifugal force employed in this newer method imparts to molten metal a degree of strength unattainable in any other metal-working technique, and it has been possible to adopt liquid forged bushings of aluminum bronze for use on variable-pitch propellers of American warplanes.

By the use of this method in production of cylinder barrels of aviation engines, a considerable saving in man-hours, use of machine tools and materials has been possible.

Another example of the benefits derived from this process is seen in the recent tests of a warplane landing-gear hinge. Previous specifications of the hinge called for nine parts with 126 inches of welding and strong enough to stand up under a design load of 209,000 pounds.

After experiments by automotive engineers, the hinge was made capable of shouldering 200 per cent of the required design load, manufacturing time was reduced three-fourths, and the hinge's weight was cut by three pounds and nine ounces by the technique.

NOTES FROM THE FACTORY FRONT

Odyssey of Machine Tools

Twenty-five years ago an automobile plant in a Michigan city boxed up a battery of multiple boring machines, loaded them on flat cars and shipped the tools to an affiliated plant in Toledo. Years later the tools moved again, to Buffalo, where they were kept working until the plant shut down its automobile lines. The Michigan plant in taking on a 75 mm. projectile job recently found that multiple boring machines needed for the work couldn't be obtained in less than three years. So its engineers combed the tool lists of many plants for idle machines and

Plant conversion underway.

spotted their old equipment of a quarter of a century ago. The tools are now back "home." Here they are being rebuilt, incidentally at a cost greater than their original price, and soon will be in production on war items.

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Ten Holes for One

Machine gun barrels get blistering hot unless cooled by air or liquid. To allow the air to circulate freely in one type of gun, 60 holes are punched in each barrel jacket. With tedious care, the holes formerly were made one at a time, three operations being necessary for each hole. Today automobile plants use a press which in one operation punches out 10 holes at once.

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Tools Crowd Parking Lot

Acres of special-purpose tools standing out in the weather give the weird impression of behemoths frozen in the snow. That sight is seen around automobile plants today where large tools, ripped from their moorings, have been rolled into vacant property to make way for new and converted war production equipment. Canvas protects some of the automotive equipment while it stands idle. Some may be moved shortly to plants having a need for it. So pressed is one automobile plant for space to store its automotive machinery that it is moving a parking lot to make the room.

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Gun Barrels

Machine gun barrels start out as solid steel bars, requiring laborious machining. One automobile company now in full production on .50 calibre guns grew concerned over the excessive scrap metal that results from machining the barrel. So it sent several metallurgical experts to its steel supplier where they worked out a change, reducing the 65-pound barrel stock then being supplied to a 47-pound stock. As the company's gun production runs in the thousands monthly, a tremendous savings of materials results.

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Big Jig

With welding ready to supplant riveting in armored tank construction, an automobile body shop practice comes into its own again. As in body work, jigs are being used to clamp tank panels in position prior to welding. There is, of course, quite a difference in size of the two types of jigs. Jigs for the final assembly of tank hull plates weigh 30 tons, equivalent to the final weight of the entire tank.

Tearing up an assembly line.

AUTOMOTIVE WAR PRODUCTION

Formerly AUTOMOBILE FACTS

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Plants Speed Output of Vital War Goods

ON JOB after job, the automotive industry is ahead of schedule in the drive to translate blueprints into war products.

One automotive company, for example, is now nine months ahead of schedule in production of powerful airplane engines for bombers. Today, one year after ground was broken for the new plant, trainloads of engines are being shipped to manufacturers of warplanes. By July of this year, the company will have built more engines than were originally scheduled through March, 1943.

Another automotive company completed its first order for 28-ton armored tanks seven months ahead of time, and, at present, this company has embarked upon a $40,000,000 expansion program that will triple the original production schedules.

Mass production of a new type all-welded tank is under way seven months ahead of schedule in another automotive company. Starting in January, this concern completed the first of these new tanks in the amazing short time of 47 days. Now on an assembly line basis, the production rate is being stepped up rapidly.

Still another firm is rushing a light tank program along in record time.

Less than a year ago another automotive firm accepted a contract from the United States Navy to build anti-aircraft cannon of foreign design. This cannon, never before produced in quantity volume, called for the highest skill in manufacturing. Applying mass production technique, the first cannon was delivered months ahead of schedule and volume production began 60 days later. Shipments during the last few months have totaled over 30 times the amount specified in the original contract. Still further improvement is expected in the coming months.

Converting two of its automobile plants to machine gun manufacture, another company delivered the first guns and began mass production eight months ahead of schedule in both plants.

February deliveries on a gun breech housing contract by another company were equal to the number scheduled for delivery in April. On another type, this same company nearly doubled the number specified for January.

Industry Calls Men Back to War Jobs

EMPLOYMENT in the automotive industry is continuing on the upswing, with each week finding more former automotive workers returned to payrolls in various war production jobs.

One automotive company, for example, recently hired the last man from its seniority list and is now taking workers from the lists of an affiliated plant in the same city.

Another automotive company is returning more than 1,500 former motor workers a week to war jobs. Another company was able to absorb its entire automotive working force with virtually no layoffs. This company has been hiring new employes at the rate of about 100 a week.

A vital aircraft job is advancing at such a pace as to allow one company to shift about 1,000 workers weekly to this new work.

Still another company is calling back 2,000 former employes weekly. By September of this year, the payrolls of this company will equal the previous all-time high.

A peacetime competitor recently acquired this automotive equipment

Drive to Expedite War Production Finds Former Competitors Helping Each Other

AUTOMOTIVE COMPANIES have tabled competition for the duration. Replacing it is a spirit of cooperation and team work, in which former peacetime competitors are aiding each other in speeding the war production job.

In need of additional heat treating facilities for a war production job, one automotive company asked for help from another automotive firm located miles across town. The second firm readily agreed to treat special steel sheets in its ovens. A transportation problem presented itself, however, as the sheet steel had to be maintained at a constant temperature at all times. To overcome this obstacle, the automotive company, which wanted the work performed, built a fleet of refrigerated trucks. They are now in constant operation, picking up the heat-treated steel and hauling it back across town to its plant.

Through the efforts of the Tooling Information Service of the Automotive Council for War Production, another automotive firm was able to locate a source to take on a difficult machining operation on a gun part. Unable to do the job itself, this firm had tried for days to farm out the job, but with no success. The Tooling Information Service was contacted and another automotive concern, with the necessary equipment to machine the part, was located. Within two hours, a supply of the parts needing the machine work had been received, and the job was in actual operation.

This cooperative exchange goes beyond the confines of the automotive industry, embracing firms which have engaged in totally different work.

A business machine manufacturer, for example, needed some sheet steel for production of a large gun. With a normal supply of this material on hand, when the complete stoppage of motor car production was ordered, several companies in the automotive industry together were able to turn over sizable quantities to the business machine firm.

In other cases, the automotive industry is calling upon firms far removed from its normal sphere. For instance, a beauty products manufacturer is turning out critically needed tools, dies, jigs, fixtures and gages for several automotive companies.

Companies Reclaim Discarded Machines

Old Equipment Rebuilt for War Assignments

TO OBTAIN equipment needed for war work, automotive plants are engaging in the reverse of Spring house cleaning.

In fact, automotive master mechanics are going to the scrap heap to welcome back machine tools which they discarded years ago.

One automotive company, for example, undertook a gun contract which called for a number of new machines. Unable to obtain them without a considerable loss of time, the master mechanic ordered all stock-rooms and "graveyards" searched for machines that could be adapted to the job. This search yielded over 50 antiquated machines that had long been discarded as useless and were standing out behind the shop.

"They were a mess," says the man who supervised their resurrection. "We had to knock the rust off with chipping hammers and chisels. But we cleaned them up, rebuilt them, and they're now turning out gun parts."

In one corner of his department he proudly exhibited an ancient cylinder grinder which, he said, had probably not been used for twenty years, but which is now being adapted to a grinding operation on aircraft engines.

Nearby his staff of machinists was converting milling machines, which had previously been used in automobile production, to handle parts of military machines.

For some of the heavier tasks, such as machining tank parts, the automotive lines contained no machines capable of conversion.

"But," said the superintendent, "one of my machinists watched the tank part operations and came up with the suggestion that it might be done by rebuilding an old 30-ton Ingersoll planer type mill that had been setting outdoors for several years. Well, we cleaned that one up, rebuilt it and put it to work."

These extensions of machine life, he added, have provided a number of fortunate stop-gaps in the present emergency. There is, for instance, a battery of 44 old gear cutting machines that the machinists are now changing over for work on a universal joint.

Putting Just One Part Into Mass Production Takes 39 Machines, Plus Many Accessories

MASS-PRODUCTION, whether of toy trains or Flying Fortresses, is the repeated manufacture of a thing by assemblage of a number of smaller things into a unified whole.

Let's say you're a motor car maker who has been asked to make parts for mass-produced military tanks. Not whole tanks, mind you, but bits, pieces, parts.

Since that is exactly what you were making when you made automobiles, it should not be hard for you to "convert" your plant. Or should it?

Let's look at one part—a transmission drive pinion. You made that part for motor cars. It's neither complicated nor simple, as you can see from the photograph. It's very much like the tank part, with a similar shape and similar function, which you are asked to make.

But . . . the part you have been making is a foot long and weighs six pounds.

And . . . the "similar" tank part is more than three inches in diameter and weighs as much as a ten-year-old boy.

So what?

Let's look at that factory within a factory, the production line upon whose 39 machines your automobile transmission pinion was made. That production line is portrayed on the chart below. It includes, besides 39 machines, 194 tools, dies, jigs and fixtures, 153 precision gages, some furnaces and straightening presses.

On the first two machines you have some forging and trimming dies, each set of which required about 600 man-hours to make. Since these forge dies shape red hot billets of steel into an approximation of your foot-long, six-pound part for motor cars, they are of course usless for forging the larger tank part.

Now, moving down your production line, you have each machine "tooled up" to perform one or more cutting operations on the smaller pinion. That "tooling-up" embraces all the things shown in circles on the chart, plus all the gages enumerated by the figures above each rectangular machine symbol.

Virtually every instrument involved in this "tooling-up" was designed to function in only one way on only this one small part.

Now, because you have a working force with that accumulation of skills that is called "know-how," you decide to mass-produce pinions for tanks.

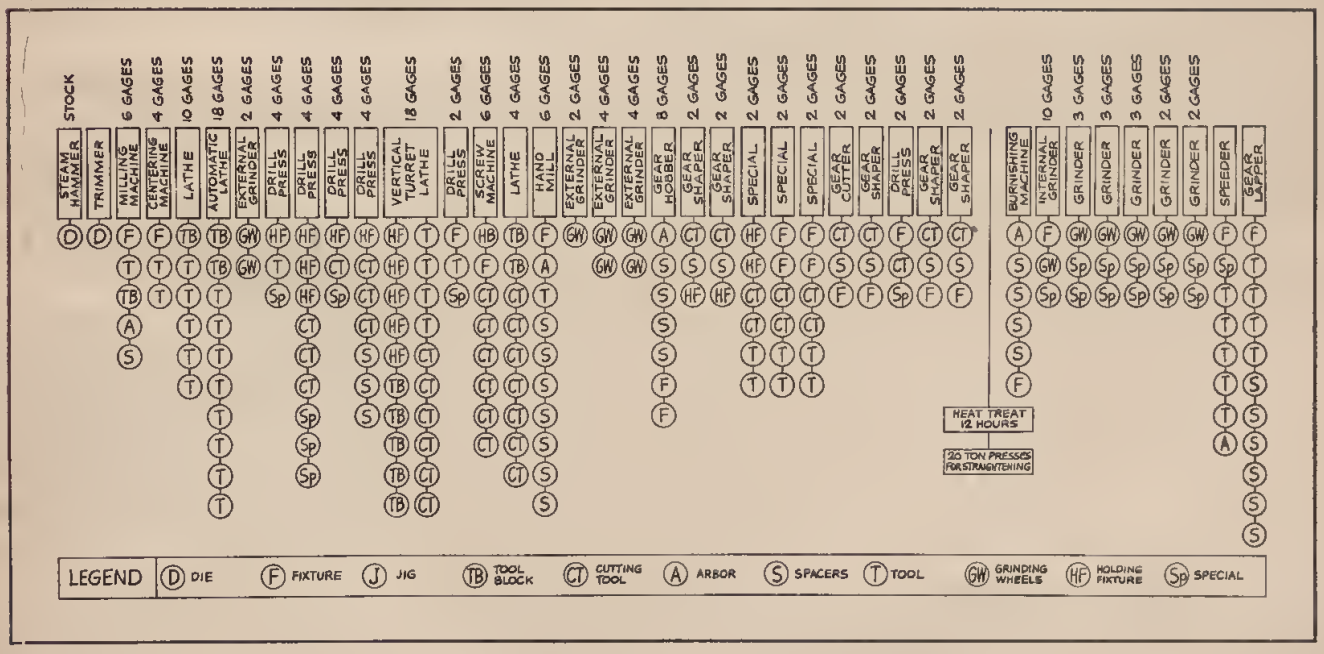
But all of the tools, dies, jigs, gages, etc., etc., will have to be thrown aside because not one of them was designed for any application to this larger part.

You not only need all new tools, jigs, etc., etc., but you must have an entirely different arrangement of machines. Moreover, in this whole line-up of 39 machines, there is not one big enough to handle the three-foot, 125-lb. bar of forged steel out of which this tank part is whittled.

An entirely new factory within a factory must be built to make this one part. It will require many larger machines and must be "tooled up" from beginning to end.

And that's conversion!

This is the automobile part



U. S. Armed Services Get Automotive Plan To Keep Planes, Tanks, Guns In Top Shape

A factory expert posses on the know-how of servicing

MECHANIZED WARFARE is less a war of machines than a contest of mechanics. This fact emerges most clearly when the shape and dimensions of an armored division of the U.S. Army are brought into focus.

Moving single file along a highway, a fully equipped division is 80 miles long. Inasmuch as the U.S. is in the process of equipping 20 such divisions, a line-up of the full force of motorized equipment, strung out along one highway, would reach from Bismarck, N. Dak., to San Antonio, Texas.

For the maintenance of such an array of motorized and mechanized might, thousands of mechanics are required. Of the 15,000 men in an armored division, about 4,500 are trained mechanics. The mechanics required for 20 armored divisions are about equal to the population of Rockford, Illinois.

In addition, this war calls for thousands upon thousands of mechanics-in-uniform in other units of the Army, Navy, Marine Corps, to say nothing of the air combat services.

To supply these mounting needs for skilled hands, the automotive industry early began expansion of its training facilities to include classroom and workshop instruction of men in the armed forces. Now there is a marked acceleration of such training.

To keep the planes, tanks and guns at the highest possible fighting efficiency, a plan has now been presented to the Army and Navy which goes far beyond the scope of the industry's huge production effort. The full facilities of one automotive company are placed at the disposal of the Army and Navy, to apply to users of war material the same varieties of service which were supplied to consumers of peacetime products.

The plan calls for the expenditure of not less than five million dollars this year on training the enormous number of mechanics required to keep a modern field force in action. Under this phase of the plan, the facilities formerly directed toward the training of employes are being expanded and applied to the training of thousands of uniformed men in scores of military and naval centers. These men, in turn, are to become instructors in the motorized services.

The plan also calls for the placement of automotive engineers in the fields of action to study the behavior of war materials produced in automotive plants and to report findings with the aim of improving the products.

Another phase of the plan calls for a supply service designed to keep replacement parts moving from the manufacturing plants to fields of action where they are needed.

The automotive program will help meet the serious needs for continuous maintenance of materials introduced by modern, motorized war. It also marks a departure from past procedure in the relationship of factory to fighting front; for, in all previous wars, the responsibility of the war contractor ended with the delivery of the product at the quartermaster depot or the arsenal.

One feature of the plan calls for the preparation of training manuals and instruction books, incorporating technical data assembled from laboratory and shop experience and based upon teaching methods developed in company schools for employes.

Facilities have been set up to train men from the armed forces as instructors in the operation and maintenance of trucks, Diesel engines, guns of various sizes, warplanes and torpedoes. These men, in turn, will serve as teachers in the Four Echelon System set up for the armed forces.

Under the Four Echelon System, enlisted men are trained for four different types of maintenance work—operation of equipment in the field, maintenance by field mechanics working from light repair units, major repairs and replacements in semi-mobile shop units, and general repairs in permanent overhaul depots.

This plan, like another company's program for training Navy mechanics, stems from small beginnings. For over a year automotive firms have trained enlisted men to maintain and service marine and aircraft engines.

Teaching in the field

•RESEARCH PAYS OFF

Science Comes to the Rescue As Material Shortage Develops

In automotive laboratories, technicians are finding alternates for scarce materials.

THE MILLIONS OF DOLLARS invested in research by the automotive industry are paying off many fold as the pinch on critical materials gets increasingly severe.

Materials developed by automotive engineers in peacetime, but "shelved" because they were then too expensive or too hard to work, are now being welcomed into war production factories. Substitutes, free of such alloying metals as nickel, chromium, tungsten and manganese, are not only practical today but are a necessity.

To merit approval of military officials, any alternate must be as good as the replaced material. In many cases it has been found that the substitutes are superior. This has been particularly true where carbon-molybdenum steels were substituted for steels with nickel or chromium contents.

The superiorities of such steels were recognized long ago in the laboratories. But their employment in the plants was restricted because full advantage of superior physical properties could be obtained only through the use of heat-treat processes that were much too costly to employ on a large scale basis.

Now that the life-and-death economy of war has replaced the dollars-and-cents economy of peace, and the men of the laboratory are given the green light on their development work, the results are often amazing.

The saving of 41,000 pounds of nickel on one company's contract for a small combat vehicle is one such example. In the manufacture of an anti-aircraft cannon, a laboratory recommendation has saved to date 420,000 pounds of nickel and 257,000 pounds of chromium on one part alone. On another part, a change from copper-tin to copper-silicon castings is saving 20 pounds of tin per gun.

In the manufacture of a shell clip, a change from a die casting to a sheet stamping has saved 3,000,000 pounds of aluminum on contracts received to date. Moreover, the decision to alter the clip actually improved it. Too, it expanded use of sheet steel and provided employment for men and machines that work this common product. (Though extensively used in peacetime, sheet steel has relatively few wartime functions.) In addition it has already saved about $2,000,000 for the U. S. Treasury through lowered costs.

Automotive engineers are constantly on the alert for new ideas. As rapidly as discoveries are made, they are passed on to all companies producing war materials. Closely guarded secrets of six months ago are now freely tossed across the table for the good of the nation.

More than 400 of the industry's best engineers are now meeting regularly to consider new problems and exchange ideas. No time is wasted at these sessions. Each problem is taken up in its sequence by the chairman and delegated to an expert who selects his assistants by cutting across company lines to set up a sub-committee of specialists.

In a recent meeting, hundreds of ideas were pooled to supply the best alternates for scarce materials specified for military vehicles. One company has found scores of substitutes for critical materials used in hydraulic brake parts. Another company's laboratory had developed processes whereby solder made of silver, antimony

(Continued on Page 6)

Ingenuity Rescues Precious Aluminum

FOR HOLLYWOOD PREMIERES and other uses, about 15 giant searchlights a year were built in peacetime. It didn't matter then that aluminum was specified. Now, the Army is ordering searchlights by the thousands to probe the skies for enemy planes. And the consumption of aluminum has become very important.

To save this vital metal, an automotive company redesigned and re-engineered the lights, replacing aluminum castings with steel stampings.

The result of this ingenuity and enterprise was the taking of 700 pounds of aluminum out of each searchlight. As an important sub-contractor for the light, the automotive concern will save hundreds of thousands of pounds of the metal a month.

The steel stampings were made interchangeable with the present castings, so that repairs can be made to any light with whatever replacement parts are available. Oddly enough, the newly designed light actually is lighter than the one made of aluminum.

Thrifty Methods in Automotive War Plants Save Vital Materials for Production Use

WITH MATERIALS feeding into the nation's war machine at an unprecedented rate, the automotive industry is intensifying its salvage operations in order to save vital metals for its ever increasing production lines.

Always actively engaged in a war on waste in peacetime, the automotive industry's plants today are using ingenious methods to recapture shavings and chips from countless machining operations.

One firm making 75 and 105 mm. shells, for example, has a system of under-floor conveyor lines which carry steel chips away from shell turning machines as fast as they are whittled off.

At the end of the conveyor a shredder chews up chips and shavings at the rate of 80 tons a day. From it, the steel is lifted automatically by overhead conveyor to a sixty-ton hopper outside the plant. This hopper, suspended over a railroad siding, drops the chips into railroad cars.

This ingenious transportation device is now rolling two carloads of steel daily to the steel mill furnaces.

Another automotive company, turning out tanks on an assembly-line basis, has worked out a color scheme in order to segregate the various metals used in tank manufacture.

As over 4,000 machines are constantly at work in this plant, grouping of the machines that work on one specific metal is impossible from a mass-production standpoint. One machine may be working on a certain type of metal, while only a few feet away another type of metal is being used. Thus, extreme care must be exercised to prevent borings, shavings, chips, etc., from becoming mixed as they flow off the machines.

Each type of metal, therefore, is keyed to a color which corresponds to that of the carts which pick up the scrap. As the shavings accumulate on the floor, they are shoveled into these four-wheel buggies and transported to one end of the plant and dumped into bins of the same color.

Using large amounts of aluminum on an aircraft job, another automotive company has worked out a similar plan to get the scrap aluminum back into its original sheet form with a minimum of time lost.

With five different kinds of aluminum, this company provided a color for each type and asked its suppliers to mark sheets to correspond with the plant colors. Stationed at each machine are carts, each painted to match the color of the metal. At intervals in the plant, 56-gallon drums, also color-coded, are provided to receive the contents of the carts.

Last month, this company returned more than a quarter of a million pounds of scrap for re-working into sheets. Of this amount, more than 90 per cent was segregated. This is a rapid improvement over the previous two months. During January, 59 per cent was segregated; in February, it jumped to 77 per cent. A higher percentage than that recorded in March is anticipated in the current month.

A hydraulic press smashes scrap metal

Research Pays Off

(Continued from Page 5)

and lead could be used in place of tin-lead solder.

A rubber sub-committee, tapping the combined lore of its members' laboratories, found uses for felt, fabrics, leather and fibers as replacements for rubber and synthetic rubber in bumpers, anti-squeak pads, gaskets and seals.

Floor plates with non-skid embossed design were recommended to save rubber formerly used in mats. For hard rubber used on steering wheels, cellulose acetate plastics were offered. For rubber used in hose and tubing, the substitute offered was extruded vinylidene chloride—a plastic unknown before 1939 and a laboratory curiosity until recently. For hard rubber of battery boxes, another company contributed the fruit of its experiments with molded gilsonite, a natural asphalt found in Utah.

On one combat vehicle alone, ingenious substitutions applied to 51 parts, eliminated all but a half pound of the almost 12 pounds of rubber used. Another military vehicle, similarly overhauled, is now rolling to the front with savings of more than 16 pounds of rubber and almost five pounds of nickel per unit.

Most of the substitutions are direct results of the automotive engineers' efforts in 1941. During this period, they were diligently searching for ways and means of conserving critical materials, in order to continue automobile production.

Patent Pool Gave U. S. Better Products

Automotive Progress Resulted from Exchange

BY POOLING technical information to aid the nation's arms production drive, automotive companies are continuing a long-standing policy of cooperation which began with the exchange of patents between competing motor companies.

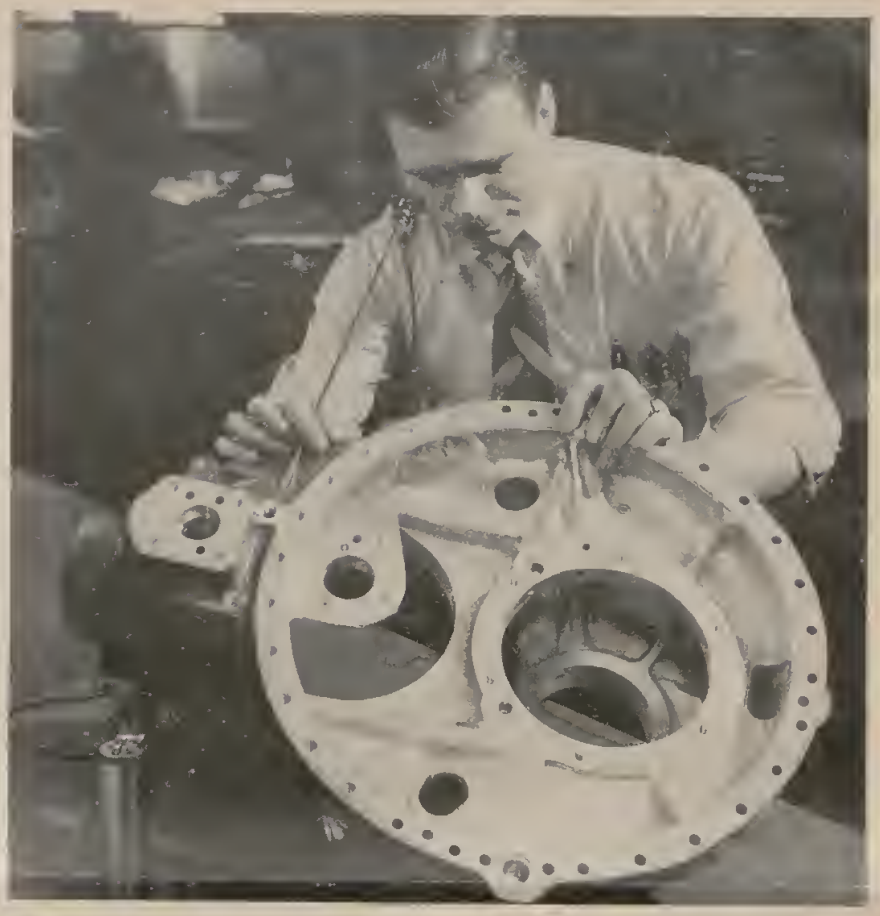
In the automotive industry today, companies engaged in making similar war items are exchanging newly developed data which has resulted in faster output, saving of critical materials, improvement of quality or reduction of costs.

As far back as 1915, an agreement was adopted by motor vehicle manufacturers to allow the exchange of patents. This was known as cross-licensing and made it possible for all firms under the agreement to obtain the use of each other's patents without compensation or fear of litigation. Thus, when important improvements were found, they were available on an industry-wide basis, with the public getting the benefits through better products at lower costs.

By foregoing the individual advantage of a patent monopoly, the industry was placed on a straight competitive basis. Engineering departments of all companies in the industry were able to devote their entire energies to building the best possible automobiles, without fear of infringement on patents owned by other motor vehicle manufacturers.

After a thorough investigation, the Temporary National Economic Committee several years ago declared that the automotive industry's policy in regard to patents is "an expression in common sense of a free enterprise which in less than a generation converted a luxury into a necessity; which, as a latter day miracle, wove the motor car into the very fabric of American culture and made its use an aspect of every day life."

The principal difference between exchanging technical information on war items and the cross-licensing arrangement on patents is that new developments are now being passed on as soon as discovered. Under the patent exchange, months of preliminary testing and proving usually preceded the making public of new developments.



Surgical Tool, Used to Remove Pins From Lungs, Now Applied to Industry's Aircraft Inspection

AS THE WAR progresses, unpublicized improvements on the weapons of war by the automotive industry come to light day by day. One of the more interesting of these is a device used to remove safety pins from babies' lungs which has been adapted to an important aircraft use.

This device, known as the bronchoscope, was invented several years ago as a surgical tool for the inspection of the inside of human lungs. If foreign matter is lodged in the lungs, this tool, equipped with highly sensitive magnifying lenses, enables physicians to quickly locate such matter and remove it without resorting to surgery.

With the automotive industry stepping into the manufacture of aircraft engines on a wide scale, one company began worrying about the perfection of drilled oil lines whose inner surfaces were invisible. If flaws were present and remained undetected, it might cause an interference in the flow of lubricants or coolants and wreck the engines of fighting planes in action.

Automotive engineers were called into discussion of this danger and the bronchoscope was suggested as a possible solution. Brought into the plant for study, the bronchoscope was adapted to industrial use and is now being used to inspect these engines that are so vital to victory of the United Nations.

Such striving for the ultimate peak in efficiency of its products is not new to the automotive industry.

In 1926, for example, one company adapted a set of .22 caliber rifle drills in building a machine for drilling crankshafts. This was the first introduction of drilled oil lines in the automotive industry and was prompted by the tendency to increase compression ratios of automotive engines. No known method then existed in the industry for drilling small holes in forged steel, and the gun industry supplied the answer.

Motor Trucks Help Relieve Heavy Burden Placed on Transportation by Wartime Demands

WITH SHORTAGE of transportation looming as a threat to the Nation's war efforts, trucks are taking on a more important role in many industries that have heretofore relied upon other forms of transportation.

For example, one of the larger lumber companies in the Northwest opened a new camp last year and purchased 10 heavy-duty, powerful trucks to handle the hauling job. Prior to 1941 the company transported all its logs by railroad, but in view of the times, good roads were built in place of rail beds, which had always been a big item of expense.

Today these 10 rugged trucks are proving the wisdom of this move by operating on a steady 12-month basis over some 8 miles of private road and 17 miles of public road. Steep grades and sharp turns present no barriers to these vehicles.

Rolling continuously from morning till night, these trucks average 200 miles daily, with about 5,000 feet of lumber carried on each trip. An efficient maintenance system has been set up to keep the trucks in perfect running order at all times.

Such a trend as this in forestry closely parallels that of the open mines and quarries where trucks have, to a large degree, superseded locomotives for transportation purposes.

All over the nation today trucks are contributing heavily to the nation's war effort because of their ability to pick up and deliver vital war materials at the exact point of need with a minimum of handling and expense.

One company solved its war production problem by employing a truck as its conveyor system to link it with five suppliers, all performing one operation on fuse plugs which it had contracted to make. Each day the truck picks up 20,000 castings at a small foundry and carries them along a 125-mile-long "assembly line" to annealing, machining and plating shops, and then to the prime contractor for assembly.

In another instance, delivery of two boring mills by truck erased a serious bottleneck that had tied up a vital United States Army contract for motor vehicle engine parts.

An automotive company needed a boring mill to complete this contract, but it was impossible to obtain a new one without a considerable loss of time. A survey was made and a used machine was located that would be available as soon as an Eastern firm received delivery of a new boring mill, on order with a construction firm in Ohio.

Arrangements were made whereby the new boring mill was delivered by truck to the Eastern firm and the old one picked up and delivered to the automotive company on the return trip of the truck to its home base. The machine was immediately put into use and the Army is already receiving parts in quantity.

Machine Tool Lists Expanding Rapidly

A LARGE PROPORTION of the machine tools and similar production equipment formerly used to build automobiles is already operating on war work, the latest compilation of the Automotive Council for War Production machine tool listing service shows.

A total of 217 automotive companies, covering 350 plants, have listed 130,000 machines with the service. So far, 102,000 have been classified. Of this total, 65,000 units or 64 per cent are already operating on war work.

Of the remaining machines, 14,000 are classified as immediately available for sale or lease; 10,000 are working on replacement parts under government schedule; 9,000 are being held for war contracts in the immediate future; 1,500 are as yet unassigned.

Complex War Products Take Added Machine Work

MANY OF THE war products and peacetime products of the automotive industry have similar names, but in numerous cases there is a wide difference in manufacturing.

For example, both automotive and aircraft engines must have connecting rods as a part of their make-up. The fine tolerance demands of aircraft engines require 97 machine operations, whereas the connecting rod in the automotive engines needed only 20 operations. Man-hour requirements are 0.2 as against 11, or 55 times as much for the "con" rod in the aircraft engine.

The difference between tank transmissions and those used in automobiles is illustrated in the fact that one tank transmission alone weighs as much as three average sized automobiles.

AUTOMOTIVE WAR PRODUCTION

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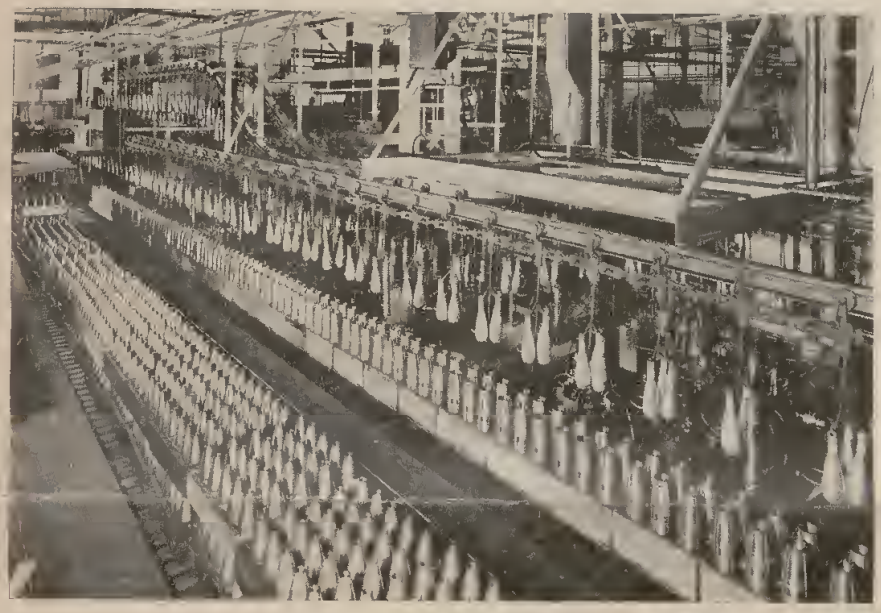


Unit costs tumble, when production reoches high volume

Automotive Methods of Production Are Lowering Costs of War Goods

AMERICA'S 132,000,000 citizens are getting more planes, more tanks, more guns for their dollars, thanks to the automotive industry's ability to effect savings in the cost of turning out war materials.

Tremendous economies for the taxpayers have resulted with automotive engineers working out production shortcuts, simplifying manufacturing procedures, eliminating waste and introducing low-cost, high-volume methods.

By shaving a few cents a unit off the cost of some articles, the industry has effected savings of thousands of dollars on items whose production volumes are measured in millions. On other military products, price reductions running as high as $1,000 a unit have been attained.

There are literally hundreds of examples of how automotive companies have achieved more efficient production—and lower prices—through use of mass volume technology, of which the following few instances are representative:

On a second order for bomber wings and nacelles, the manufacturer contracted to do the job on the basis of less than 50 per cent of the originally specified man-hours.

Placed in production 18 months ago, an automatic gun cost around $1,200. Within six months more than $250 had been cut from cost, while today's price is nearly 40 per cent lower.

On another vital ordnance item, the government is paying 43 per cent less than it did at the start of production.

Use of automotive-type machine tools and fixtures enabled one automotive company to cut the time required for one bomber wing panel operation by 75 per cent—and resulted in a re-

(Continued on Page 2)

Bomber Production Ahead of Schedule

Bomber parts and sub-assemblies are rolling off production lines of automotive plants in ever-increasing numbers. Shipments to final assembly plants of the aircraft industry have been under way for several months on several types of airframe sections.

One automotive company, for example, hired its first aircraft workers in June, 1941. One month later production was under way on a few parts, with finished bomber sections being made and shipped, less than four months later.

In January, 1942, the first Army bomber, assembled from parts fabricated by this company, rolled from the production lines of a new mid-western plant several months ahead of schedule. Since then shipments have steadily increased each month.

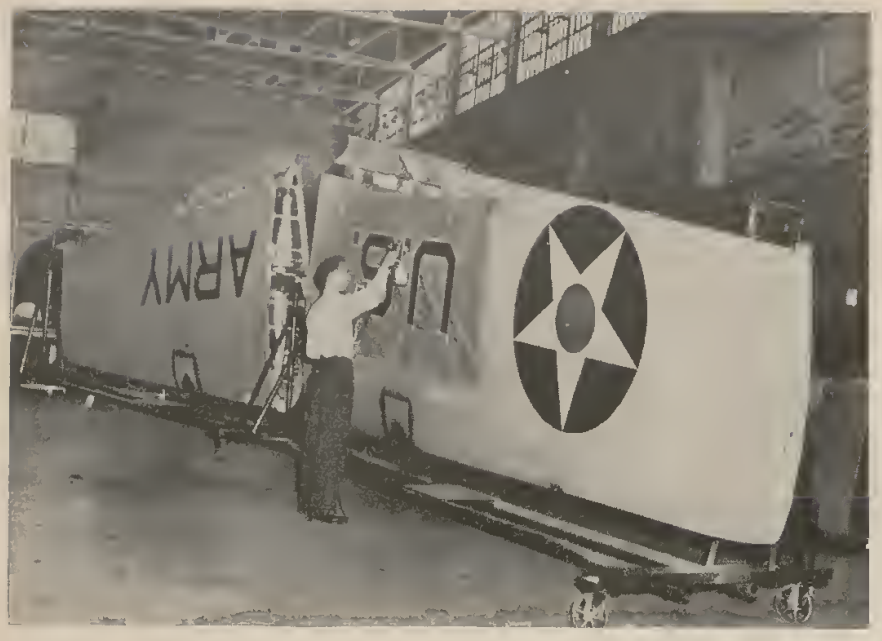
In March, shipments scheduled for the entire month were completed in the first week. April shipments were greater than for any previous month, and May deliveries likewise will exceed any previous month.

The parts program of this company has proceeded so rapidly as to allow freight car shipments of such parts as cowlings and exhaust manifolds for large bombers. Never before in the history of aircraft production have these been made fast enough to warrant car load shipments.

Another automotive company is far ahead of schedule on rear fuselage sections for high speed medium bombers. Within eleven months of receiving a letter of intent from the War Department, the first deliveries were made.

Since extremely high precision is required on this type of airframe, rejections previously had run high. The very first section turned out by this former builder of passenger motor cars, however, passed all inspections

(Continued on Page 2)



Bomber Sub-Assemblies, Parts Being Shipped By Automotive Plants Ahead of Schedule

(*Continued from Page One*)

and fit perfectly in the final assembly.

Employing automotive-type assembly lines, another company has already reached quantity production on nose and center sections for medium bombers, after having received blue-prints of the final designs only last January. Just as in automobile days, conveyors carry hundreds of sub-assemblies and thousands of parts along to final assembly. In all, more than 15,000 parts are handled.

One of the first to take on orders for airframe sections for bombers, super-speed fighters and observation craft, another automotive concern reached the mass production stage eight months ago. This company now is 39 per cent ahead of schedule on one wing contract, 38 per cent ahead on another, 13 per cent ahead on an extremely large wing section, and 20 per cent ahead on another contract.

After turning out bomber parts and sub-assemblies for several months, one automotive company is now in production on complete four-motor bombers. This is an outstanding record, since only 13 months ago ground was broken for the new plant. The deadly winged fortresses, that soon will be rolling out of the plant, will be wholly automotive-produced, inasmuch as the engines are being turned out by another automobile firm.

A supplier to the automobile industry, entering the airframe field only a year ago, recently reached maximum production 11 weeks ahead of forecast dates. Engine nacelles and wings for several different types of planes are being shipped to the West Coast ahead of schedule.

War Costs Lowered

(*Continued from Page 1*)

duction of $1,000 in the price of the completed unit.

A price cut of 30 per cent has been made on one important aircraft accessory since it has reached mass production; another was slashed nearly 30 per cent and still another 44 per cent.

The automotive industry is saving the nation hundreds of millions of dollars despite the payment of top wages as compared to the general industrial ceiling and despite the fact that it has steadily less opportunity to absorb cost by technological change in view of the tight tooling picture.

Yet the industry's ingrained second nature—acquired in what is the world's most competitive industry in peacetime—makes it axiomatic for automotive companies to operate on the basis that fortune in war as well as in peace favors the most efficient producers, the most efficient industries and the most efficient nations.

Unusual Sources Supply Special Machine Tools

Plants Scour Nation For War Equipment

UNUSUAL EXAMPLES of the cooperative effort being made by automotive companies to speed the nation's war production program are almost daily revealed in records of the Tooling Information Service of the Automotive Council for War Production.

An Ohio stove company, for example, was not only able to place orders for tools needed for machining a tank part, but an automotive firm voluntarily engineered the entire job. Information was freely turned over on proper machine sequence, types and numbers of machines needed, and other data that would get the job underway rapidly and efficiently.

Going far afield in its work of discovering equipment which can be utilized, the Council has turned up many unusual sources.

One such, for example, was that of a southern Indiana limestone company whose huge planers, used to cut 15,000-lb. blocks of stone, were found to be exactly the tools needed by an automotive firm to machine large metal plates for aircraft work.

In another instance, an automotive firm needed a special machine tool for work on a shaft that was four times as long as an average-size shaft. After locomotive round houses and other similar sources were contacted in the search for suitable equipment, a machine of the right size was unexpectedly turned up in a chemical firm.

On its tank assignment, one automotive company found it needed turning equipment for a piece 78 inches in diameter. After an extensive search, it was finally located in a nearby railroad shop.

Another automotive company recently called on the Council for help, after all its usual sources were unable to take on work, which required the use of jig borers. The Tooling Information Service immediately made a survey of 50 different shops and found five who were able to handle the work between them.

One company, engaged in work on a 20 mm. projectile, was able to place orders for 287 different jigs, gages, and fixtures through the efforts of the Tooling Information Service.

Vital Aircraft Role Played by Tiny Units

A WARPLANE is a big thing composed of millions of little things. The efficiency of the big thing is the sum total of the efficient functioning of each component little thing.

In work applied to some of these important little things, the automobile industry has made its most significant contributions to the building of American warplanes.

To "keep 'em flying" the instrument panels of warplanes bristle with scores of indicators, such as fuel gages, manifold pressure gages, artificial horizons, turn and bank indicators. Many of these delicate instruments contain bearings. Until recently, such bearings were watchmakers' jewels.

Then the spread of war interfered with the sources of supply and it became imperative to find a substitute for jewels in the United States.

Exactly six weeks after the need emerged, an automobile manufacturer's bearing research specialist perfected complete processes and equipment to manufacture the smallest ball bearing assemblies ever made in America.

The steel balls in these assemblies have diameters of 1 mm., or slightly less than four one-hundredths of an inch, and weigh .000144 ounce each.

Now in use in aeronautical instruments, these microscopic ball bearing assemblies are proving to be better than jewels, which sometimes cracked under the stresses of vibration and severe changes in temperature.

Motor Plant Workers Donating Guns to U. S.

ENGAGED IN turning out anti-aircraft guns on a mass production basis, workers of one automotive company have formed a Gun of the Month Club for the purpose of presenting, as a gift to the nation, one of the guns each month.

Meanwhile production of these anti-aircraft guns has expanded by leaps and bounds. Output is nearly three times higher than called for in the original contract, while in a recent month production was four times as high as the previous month.

This tank riveting equipment already is a victim of new technology.

Year-Old, Giant Machines Already Outmoded By New Tank Manufacturing Techniques

EVIDENCE OF HOW rapidly production techniques on war jobs are changing is given in the story of the giant riveters, only a year old, which soon will have outlived their usefulness in tank work.

Developed and built last year by one automotive company for its tank job, these giant machines are being laid aside, because of the Army's recent decision to switch from the riveted to the all-welded tank.

To employ in tank production the cold-riveting process that had previously proved successful in automobile-body riveting, this company designed huge horseshoe-shaped riveters to do the job.

Some stationary and others brought into position by overhead cranes, these machines exerted as much as 100 tons of pressure in squeezing rivets into place.

Frictional heat induced by this tremendous pressure expanded the nickel steel rivets and improved their strength, whereas in the previous method of heating and hammering, some of the desirable qualities were lost.

This method was so successful that more than 95 per cent of the rivets used in the tank hull were inserted by cold riveting. Hot rivets were used only in the tight spots that would not allow entry of the large machines.

Yet, experiences gained from major tank battles such as took place in the Libyan desert last year prompted Army officials to switch from the riveted to all-welded tanks. One of the major advantages of the new model tank will be the ability of the all-welded hull's curved surfaces to deflect projectiles more readily.

Thus the giant riveters, which cost thousands of dollars to build, must be laid aside. They will, however, be made available for other war work to which they can be adapted.

However, while this notable automotive development has been superseded, another automotive company has now come through with a radically new method of welding tanks which is of equal manufacturing importance.

This company has designed and built huge fixtures to hold plates and sub-assemblies in place prior to welding into the one-piece hull. Weighing 30 tons—as much as the completed tank itself—the fixtures are equipped with a cradle-like framework that permits them to revolve barrelwise and tilt up on either end. Thus all welding may be speedily performed in the desirable down-hand position.

Automotive Industry Develops New Methods For More Efficient Shipping of War Goods

These special cantainers facilitate shipment af aircraft parts.

WITH WAR MATERIALS streaming from automotive assembly lines in an ever-increasing flow, automotive shipping departments are developing many new, efficient methods of boxing, crating and transporting finished products.

Recently one automotive company converted containers—previously used to ship automobile body parts—to handle shipments of large aircraft bomber sections.

Heretofore all airplane parts were shipped by the use of wooden crates built specially for particular sections. Besides involving excessive construction work, the weight of these crates boosted freight charges considerably.

Amount of dunnage (packaging material) required for shipment of parts has been greatly reduced. When the containers are loaded witb wings, rudders, stabilizers or ailerons, each part is held in place with straps which tend to absorb any impacts incurred during transit.

A similar plan is one in which special freight cars, equipped with end doors, raised roof, steel floors and racks, have been provided for shipping aircraft subassemblies from a Detroit automotive plant to a West Coast assembly plant.

Turning out tanks on a mass production basis, another automotive company has conserved shipping facilities by developing a new method of loading tanks on flat cars.

Forty-foot flat cars were previously limited to a load of only one tank, due to the extensive crating used to secure the tanks. Inasmuch as the load capacity of most of these cars was capable of carrying two tanks, one company sought ways and means of conserving space. By redesigning the blocks which anchor tanks in shipment, this company eliminated sufficient dunnage on each end to allow for the loading of two tanks on each car. Other innovations make it possible for two men to load a freight car in less than two hours. Previously it took four men approximately eight hours.

In production of bomber parts and sub-assemblies, another company is holding costs to the minimum by utilizing excess materials, that normally would be thrown away, for crating small finished aircraft products for shipment.

Aluminum sheets entering the plant for fabrication are boxed to insure safety and facilitate bandling. These boxes are made of thick pine wood on the bottom, with two-by-fours adding support and acting as a skid. On the sides and top, thin plywood is provided merely as protection against scratches and dirt.

A special department has been set up in which this material is now cut down and remade into smaller boxes for shipping finished products. The plywood is used for shipping lighter parts, such as plexiglass turrets and gasoline tanks. Bomb racks, stainless steel parts and other heavier equipment that must be held secure in transit are crated with the pinewood and two-by-fours.

Rigid Army Demands Met by Motor Vehicles

IS IT A SNAP? Can you stop making commercial trucks one day and start rolling out military vehicles the next?

Before you take an Army truck order, give some thought to the requirements.

To pass Army tests, for example, trucks must operate without overheating in at least 120-degree atmospheric temperature. The carburetion, oil level in engine, transmission and rear axle lubricant, and all other functional accessories must operate on grades as steep as 65 per cent.

The vehicles must be capable of functioning at reasonable speeds in deep water, which means the sealing of ignition and lighting systems. To keep pace with marching troops when necessary, the trucks must idle along at continuous operating speeds of 2½ miles an hour, without overheating.

And like commercial operators, the Army demands maximum fuel economy in all its vehicles, realizing that a small savings per unit represents a huge cumulative total. Based on a savings of one mile per gallon, 10,000 vehicles operating at maximum power for a ten-hour period could save as much as 245,000 gallons. Naturally, a number of extra vehicles would have to be employed to supply this additional fuel every ten hours.

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MEETING THE CHALLENGE

The Automotive Industry Reports to Nation

THE MIGHTY stream of automotive production, rising and roaring like a flood, is now sending ten million dollars' worth of military equipment a day to the armed services.

Guns . . . tanks . . . shells . . . airplane engines . . . marine engines . . . bomber sections . . . military vehicles. These are the major products rolling from automotive assembly lines to give America the strength "to meet the enemy whenever and wherever we can find him."

Staggering in magnitude is the job the automotive industry is called upon to perform: Three-fourths of all aircraft engines, over one-third of the machine guns, more than two-fifths of the tanks, more than half the Diesel engines, and 100 per cent of the motorized units are to come from motor plants.

But, the 986 plants in 31 states that comprise the automotive industry, say to the Nation, "The Job Is Being Done." In a progress report by that name, issued by the Automotive Council for War Production, it is stated that, "on assignment after assignment the automotive industry is ahead of schedule. The production stream is swelling mightily by the hour."

Progress since the outbreak of war may be judged by the steady increase of deliveries:

From Pearl Harbor to Dec. 31, deliveries totaled $120,842,267, which is equivalent to an annual rate of $1,837,000,000. By the end of May, monthly output had jumped to $311,360,836, or an annual rate of $3,736,000,000. Indications are that deliveries will soon be well above a yearly rate of four billion dollars.

Adding significance to this record is the fact that defense orders, prior to active participation by the United States in the war, were relatively small compared with the huge assignments in the weeks following outbreak of hostilities.

It was January 1, 1941, for example, before orders totaled $1,000,000,000. The second billion was reached in May, the third in August, and the fourth in October. At the time the Japs struck at Pearl Harbor, total orders amounted to 4.8 billions.

On December 8, Army and Navy officials and others vested with the responsibility of placing orders went into action. Telephone communication between Washington and automotive centers reached an all-time peak. Before the end of January, orders had reached $10,000,000,000 or more than double the total orders allotted automotive companies during the entire defense period. The rise continued until total accumulated contracts amounted to $12 billions in February, $13 billions in March and upwards of $14 billions at the present time.

To handle this huge load, the automotive industry destroyed itself as a producer of passenger automobiles and trucks. Machines were uprooted and scattered wherever they could be utilized in the war effort. Competition vanished in what in peacetime was the world's most keenly competitive industry.

"SCRAPPING" FOR VICTORY

Every Nook and Corner Being Scoured By Automotive Firms for Vital Metals

This obsolete metal will supply our fighting forces with guns, shells, planes.

HOUSE CLEANING—from attic to basement!

That, in effect, is the order of the day in the automotive industry in this critical summer of 1942.

The Automotive Council for War Production salvage and conservation committee has under way an industry-wide program to collect every available ounce of critical material.

For the drive which began on June 15, more than 300 automotive companies appointed salvage authorities armed with extraordinary powers to render final decisions as to the fate of plant equipment.

The decisions which the salvage authorities must make this year are not unlike those which confront the housewife who, having reared a family in a spacious house which must now be vacated, faces the task of deciding, before the movers arrive, what accumulated items in attic and basement shall be saved and what must be scrapped.

"Whichever you do, you'll regret it," said Socrates to the man who asked him whether it was better to marry or not. Acutely aware of the certainty of such regrets, the salvage authorities are shouldering the heavy responsibilities of deciding the fate of tools, dies, patterns, jigs, fixtures, machines and even buildings.

Early reports indicate that the industry-wide house cleaning is to be thorough. Some unusual sources of scrap metals were immediately uncovered in factories whose operators thought they were "clean."

For instance, one company's "basement"—a series of tunnels connecting several buildings—yielded 30 tons of abandoned and forgotten pipe. Exploration of "attics" turned up tons of obsolete dies and patterns in one factory's dusty lofts and warehouses. In one case such an "attic" foray recovered a sizable load of scrap in the form of dismantled steel signs from the roof.

Within a few hours after the industry's program was formulated and approved, the first reports of resultant action began to arrive at the ACWP headquarters. Among the early reports was one from a company which formerly manufactured automobile and truck parts and is now engaged entirely in production for war. Though not one of the largest automotive manufacturers, this company reported the immediate return to the mills of almost five million pounds of scrap, composed of segregated lots of iron, steel, copper and brass. Though mostly turnings and cuttings from machines, the shipment included a large amount of discarded idle equipment.

Another relatively small company, engaged in steel pressing operations, immediately released more than 90 tons of iron and steel from idle equipment held to its account in the warehouse of one of its suppliers.

Most dramatic were the results reported by one former manufacturer of automobiles.

In this company the salvage authority summoned all the supervisory personnel into a meeting and instructed them to enlist the help of all employes in a thorough house-cleaning of the premises.

"Well-kept factories, like well-kept houses," he said, "have attics and basements which somehow persist in remaining cluttered no matter how often or how thoroughly they are housecleaned. It's human nature to want to hang onto things of questionable value just in case a need for them might one day turn up."

Pointing out that the disposition to hoard useless stuff is as strong in the good factory foreman as it is in the good housekeeper, he added:

"Though it is good economy in normal times, these are not normal times. To produce for victory we shall have to scrap things which we'd like to save."

Thus instructed, the employes joined in this company-wide "scavenger bunt" as though it were a game. They were supplied with red tags to mark every piece of equipment whose use value they questioned. An amazing amount of scrap was turned up by this method.

Plant maintenance workers, taking a fresh look at the factory "basement" discovered the abandoned pipe, previously referred to, and hauled it to the scrap pile. Another group of employes stormed through their department's "attic" (an abandoned lumber kiln) and hung red tags on hundreds of heavy forging dies which had been stored on its four floors. Another "attic raid" resulted in the management's decision to pull down the steel signs whose ten-foot letters had advertised the company's peacetime products.

The company's gray iron foundry,

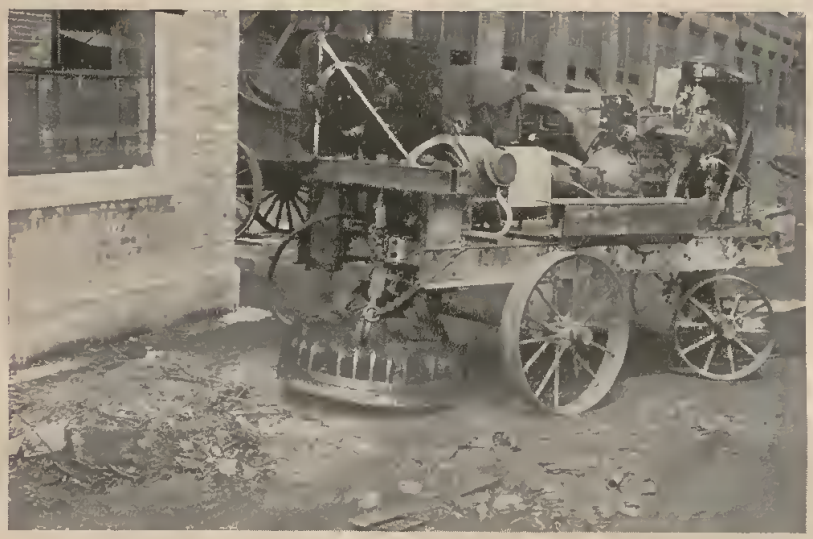
shut down for lack of wartime needs, was divested of a 1,500-ton pile of pig iron and a huge unmeasured accumulation of foundry scrap.

In the first week of this company's operations, a total of 1,156,000 pounds of dormant equipment was hauled out to two steel mills in 17 railroad cars. In addition, the company authorized one of its suppliers to scrap a collection of obsolete tools and dies which, representing an initial investment of about $4,500,000, yielded 2,000 tons of cast iron and 500 tons of steel.

The foundry pattern shop storeroom was re-examined and a small crew was set to work dismantling obsolete patterns into their components of steel, iron, aluminum and brass.

Stocks of service parts were inventoried, in the company's warehouses, in the stores of parts and replacement departments, and in the possession of dealers and distributors.

SERVING DUAL WAR ROLE



AN IMPROVISED VEHICLE, created by an automotive company to make its salvage drive more effective, has unexpectedly brought another important result—it has cut down the number of punctured tires on Army trucks.

Because the company's salvage crews were so zealous in transporting metal to the scrap pile, the factory pavements and cinderized roadways became littered with small dropped fragments that endangered pneumatic tires. To sweep this menacing metal from the path, the salvage crew devised a vehicle which they call their "scavenger."

Upon a small wagon fitted with steel wheels, retrieved from some junked farm machinery, they mounted a re-built automobile engine and an electric generator. From the back of the vehicle they suspended an electromagnet which they salvaged from an idle foundry crane. Pulled by a farm tractor, this vehicle followed every scrap-hauling truck, retrieving the dropped nails, screws, etc.

Shortly after it went into operation the company's director of transportation noticed a sudden decline in the number of punctures in the tires on combat vehicles which the company manufactures for the Army.

Investigating the action of the "scavenger," he discovered that the magnet was actually "mining" the cinderized roadways for small iron and steel particles hidden just under the surface. So he ordered it to be operated over the surface of the plant parking lots on a continuous basis.

In the first fortnight after such operations were started, not one punctured tire on Army vehicles has been recorded. Because of this encouraging result, company officials have authorized construction of an improved "scavenger."

Better Gun Results From Metal Research

Substitute Material Saves Time and Alloy Steel

IN WAR production, as in football, the substitute frequently scores the touchdown.

This is being demonstrated as the automotive industry searches for replacements to relieve critical material shortages.

In making an important piece for a heavy machine gun a former automobile maker produced a casting to replace steel tubing. The purpose, of course, was to effect a large saving of alloy steel in the manufacture of thousands of machine guns. But it was found that use of the "substitute" also greatly reduced the production time and resulted in a unit of higher quality.

The new part is made of a special iron which an automotive foundry had developed.

With the approval of Army Ordnance engineers, a sample was cast, machined and assembled into a gun for testing.

"I kept my fingers crossed when the Army inspector took the gun into the cold room and began whacking at it with a heavy steel bar," says the automotive factory manager in relating the story of the development. "I thought he was not being impartial when I saw him hit the standard unit only twice and then wallop our experimental gun eight times; but, after he came out of the cold room, he explained that the second blow had buckled the regular unit and that our cast substitute had come through undamaged."

Having won official approval, the substitution has effected larger savings of time and material than even its original proponents estimated.

The section of tubing which was replaced had weighed 20 pounds in the rough, and was whittled down in a series of machine operations which reduced it to a thin cylinder, pierced with many holes, and weighing less than five pounds.

In other words, manufacture of the part, as originally specified, required handling, machining, scrapping, transporting and re-melting of three-quarters of the steel in the original piece.

Refinement of the casting, on the other hand, sends only 1½ pounds of steel into the salvage bin. The reduction in man-hours required for machining alone is more than 45 per cent.

Long a vital part of automobile manufacture, sub-contracting has been further intensified in war production. Above are shown oil coolers for Diesel submarine engines undergoing inspection before being shipped to final assembly plants.

Long hours were spent by automot techniques for quantity output of w of foreign design, others previously

Though it began less than two years ago, the first automotive concern to enter the tank field is now producing monthly more tanks than were built by entire U. S. in World War I. Daily trainload shipments have been underway for several months. Other automotive firms have since been assigned tank work and are now in production or rapidly completing the tooling job that is required.

MEETING THI

CLOSE TO 300 kinds of material—ranging from air-raid sirens to giant tanks and four-motored bombers—are being built by former makers of cars and trucks.

Citing scores of specific instances, the report on "The Job Is Being Done" shows that production has been stepped up many times; critical materials have been saved; new techniques have been developed to speed manufacture; and costs have been reduced.

Companies opened their vast stores of experience and ingenuity to each other. Individual problems were not tackled individually, but they became the problems of the entire industry.

Machine tools and other facilities were exchanged, so that existing equipment would be utilized to the fullest. Long an established practice in building automobiles, sub-contracting was intensified to get every possible source of supply working on war orders.

Setting a new precedent, automotive companies established many schools, in which Army officers and enlisted men were taught

Adapting automotive methods of mass production to shells has resulted in output numbering in the millions. Tooling up to produce one million large shells, a motor car firm turned out its second million in 55 days and third million in 35 days.

Aircraft production is a big part of are building engines, six airframes shipments of both engines and airfro

ive engineers in planning the proper
r materials. Numerous products were
were made by tedious hand methods.

Educatianal programs have been set up by autamotive companies to teach Army and Navy officers and enlisted men the way to maintain equipment. Ensign Cax, one of the heraes of the mosquito fleet, received training at such a schaal.

E CHALLENGE

maintenance techniques that would assure peak performance of automotive war products in the field. Previously, all responsibility ended with delivery of the product.

As Alvan Macauley, President of the Automotive Council for War Production, declares in a foreword, "the motorized might which shattered the world's peace has challenged the motor-making might of America. In goading American minds and hands into using mass production techniques of peace for the purposes of war, the enemies of free men have released the power that can ride them down, drive them to earth, destroy them."

Though production rates on individual war products are military secrets, the publishable facts of the report—many of which are highlighted on these pages—show the job is being done.

Copies of the 32-page booklet may be obtained by writing the Automotive Council for War Production, New Center Bldg., Detroit, Michigan.

Ingenuity and resourcefulness af automotive engineers have saved time and maney on the aircraft job. On one bomber wing and nacelle, man-hour requirements were cut more than 50 per cent. Time on a wing panel job was cut 75 per cent and costs reduced more than $1,000 per bomber. Scene on the right shows a toal room where jigs and fixtures are being built.

he automotive war effart. Seven firms
nd several complete planes. Carlaad
.es are being made ahead of schedule.

All military vehicles, from quarter-ton reconnaissance cars to 40-tan tank transporters, are rolling ta fighting fronts fram the industry's truck plants. Mabile units in the field are pravided far virtually every operation of a standing home army.

AUTOMOTIVE
WAR PRODUCTION

Published by
PUBLIC RELATIONS DEPARTMENT
Automotive Council
for War Production

HARRY A. WILLIAMS, Editor

New Center Building, Detroit, Michigan

Advantages Shared By Motor Companies

Competitors Producing Firm's Prize Possession

ANSWERING the nation's call to arms with a cooperative response unprecedented in industrial history, automotive companies are setting aside competitive advantages to expedite the output of war materials on an industry-wide basis.

One automotive parts concern, for example, recently revealed that it had turned over to the American government, nearly two years ago, free rights for its competitors to build the company's choicest possession—a wheel that had won high praise for distinguished service in World War I.

This wheel was used in carrying allied trucks and artillery in World War I, and its inventor received the Croix de Guerre from the French government.

At the termination of hostilities in 1918, the design was brought to this country and the automotive firm began turning out the wheel for American vehicles. Many improvements and design changes have naturally been made to keep in step with the rapid progress of the industry.

When the United States armed forces were confronted with the need to standardize on one type of wheel, this company on July 25, 1940—just five weeks after the fall of France—voluntarily assigned free rights to the government for the duration.

At the present time, about 75 per cent of the wheels are being manufactured by the company's peace-time competitors without royalties.

Do You Know?

Filing intricate gun parts used to require the services of a man with five to six years' experience behind him. It took the man 30 hours for the job. Now with the job broken down into its component parts, an automotive company has 30 men with 30 days' training doing the job in one hour each.

* * *

A new machine being used by a former motor car firm for building center wing sections of bombers simultaneously performs 87 operations that formerly were done by hand.

* * *

An automotive company, taking on a contract for aircraft engines, early set out to overcome the shortage of magnesium. Setting up a complete foundry, this company is not only filling its own needs but is the principal supplier of magnesium to an aircraft firm.

* * *

A truck trailer combination that rolls on five axles and 18 wheels has been designed by an automotive firm to haul bomber parts, which it is making, to assembly plants. Two such units carry all parts for one complete four-motor bomber, whereas similar shipment by rail would require seven freight cars and would take 150 more manhours.

* * *

Automobile dealers are helping to relieve the critical shortage of heavy-duty trucks by expanding capacities of medium size models. Complete instructions on the conversion job have been made available by one factory to all its dealers. Capacity of a highway tanker was recently increased from 14,000 to 56,000 pounds gross weight by the addition of a tandem drive rear end, special transmission and tandem semi-trailer.

* * *

One type of machine gun being manufactured by an automotive company involves more than 1,800 separate machining operations, of which 66 are required on the bolt alone.

* * *

Motor trucks for the Army are built to climb 65 per cent grades, slopes so steep that men cannot negotiate them on foot.

Cold, Adapted to Industrial Uses, Is Resulting In Better Warplanes for United Nations

AND NOW cold is being put to work to defeat the Axis.

True, the extreme cold of a Russian winter upset the Nazi time-table of quick and easy conquest, but the cold which is now going to work for the United Nations is low temperature, not on a rampage in the form of weather, but controlled and harnessed in the laboratory and the factory.

Here are a few examples:

In the factory of a former builder of automobile bodies, conversion of facilities to the manufacture of parts of bombing planes introduced the company's engineers to an interesting fact: Light metal alloy sheets rapidly harden with age between heat treatment and forming operations.

To slow down the age-hardening, the heat-treated sheets are now carried from the electric furnace to a cold water bath; then they are transferred to portable dry-ice refrigerators and stored at zero Fahrenheit until forming and drawing presses are ready for them.

In another former motor car plant, cold has been harnessed and is being ingeniously employed to achieve a tight fit of aviation engine cylinder barrels. The holes in the light metal alloy casings which provide the seat for the barrels are actually machined with smaller inside diameters than the outside diameters of the barrels that they are to hold.

Coming together at the assembly line, the casings are placed in a furnace which expands their dimensions. Close to the furnace there is a dry-ice refrigerator in which the barrels are subjected to sub-zero cold which shrinks them. After a proper interval, the shrunken barrels are dropped into the expanded casings and, as the assembly returns to normal temperatures, the resultant fit is a perfect bond between the two metal parts.

Automotive Industry Exceeds All Schedules In Carrying Out Machine Gun Assignment

MEMORANDUM to Hitler, Hirohito and Mussolini.

Re: machine gun production via the automotive industry.

Deliveries as of May 1, 1942, were being made at a rate 22 times in excess of original contract schedules; manufacturing time cut 49 per cent; costs reduced 49 per cent on each gun.

This does not pertain to the accomplishments of the entire industry, but this is the progress of one company that began production of 30 and 50 caliber machine guns just a little over a year ago.

Originally scheduled to get under way Dec. 1, 1941, this company, when the need became greater, was asked to step up its preliminary tooling work, so that production might begin June 1. Not satisfied with merely meeting this new request, the company proceeded to turn out its first guns April 1—a full eight months ahead of the original schedule.

Machine guns have been rolling from assembly lines of this firm at an increasing rate ever since. By February, 1942, for example, deliveries were more than double the rate of three months earlier. By May, deliveries of February were doubled. At the same time, the concern has turned out 31 per cent more extra barrels than were called for in the contract.

Using previous manufacturing of machine guns as a basis for determining costs, this company set an original price of $967 a gun. This has since been reduced downward—first to $892, then to $590 and finally to $496, a saving of $471 on each gun. More than 60 per cent of the contract will be filled at this latter figure.

Many ingenious shortcuts have had to be worked out to accomplish this high rate of production and reduced costs. Working with Army ordnance officers, automotive engineers were able to introduce such innovations as adopting a chemical cleaning process, that had been used for cleaning metal grilles in automobile manufacture, for cleaning machine gun barrels. Hours were reduced to minutes by this process.

More than two hours were saved by applying assembly line practice—each operation being done in its proper sequence for progressive manufacture. By an improved riveting system and adopting multiple brazing instead of single torch brazing, close to three hours were saved on each gun.

As previously stated, these accomplishments are those of only one company. But a glance at the record will show that equally impressive records have been made by all automotive companies on a wide variety of war products.

Wartime Truck Role Stressed In Booklet

54,000 Communities Dependent on Trucks

THE IMPORTANT role of trucks, both private and commercial, in the war effort adds significance to the material contained in the fifth edition of Motor Truck Facts, a statistical review just off the press.

What a tremendous job trucks are doing is indicated by a survey of 741 war plants in Michigan, showing that 65 per cent of all freight received by these factories is hauled by trucks as is 59 per cent of outgoing freight.

A total of 54,000 communities, with a combined population of 6,900,000, are entirely dependent on motor trucks for freight service, the bienniel publication points out.

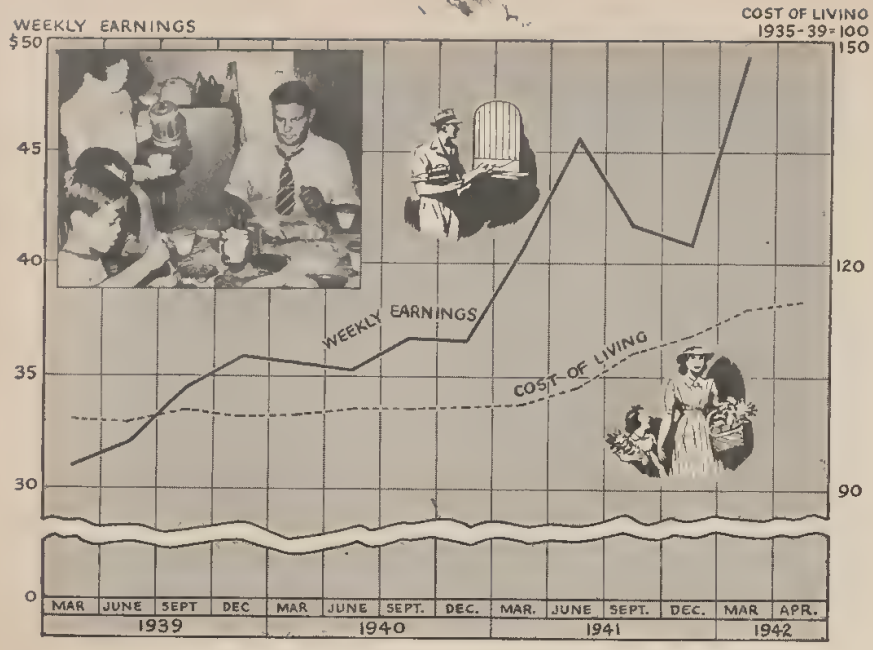
Production during 1941 reached an all-time high of 1,042,085 commercial units. Truck-trailer output for the year totaled 40,800.

A nationwide survey shows that of all trucks on farms, one-third are more than ten years old.

The widespread ownership of motor trucks is reflected in the table which reveals that 88 per cent of all truck operators own only one vehicle.

Other pages of the booklet reveal that one-fourth of all trucks in the nation are used by farmers; 20 large cities are dependent on motor trucks for milk; commercial vehicles shipped 25 million tons of coal from mines to consumers in one year; 94,000 trucks are used by railroads; 59 per cent of all livestock and nearly half of all fruits and vegetables are hauled to market via truck transportation.

Special federal, state and local taxes on commercial vehicles hit a new peak of $546,290,000 in 1941. With conservation an important problem in the nation today, the pages devoted to maintenance, pooling and limited delivery schedules are of particular interest.



Average Weekly Wages at All-Time High In Automotive Industry, B.L.S. Figures Show

THE AUTOMOTIVE worker's average weekly paycheck, according to the latest report of Bureau of Labor Statistics, is at the highest point in history both in dollars and in actual purchasing power.

Due in part to overtime work and top wages paid skilled employes, the average weekly wage has advanced to $50.29, as of April 15, date of the latest available report. While the cost of living has also increased, "real earnings," or actual purchasing power, are also at an all time high. Since March, 1939, cost of living has increased 16.1 per cent, but weekly earnings have increased 62.9 per cent.

Today's paycheck of $50.29, at today's prices, buys as much as $43.30 would buy at 1939 prices. The actual wage in March, 1939, was $30.87, so that in spite of rising living costs, the "real earnings" of automotive workers are still 40.3 per cent higher than earnings in March, 1939.

With the spring decline in employment far less than had been anticipated, these figures give a broad picture of both skilled and unskilled workers and is conservative inasmuch as new war plants being operated by automotive companies are not included by the Bureau of Labor Statistics.

This is borne out by a compilation of weekly wages made by the Automobile Manufacturers Association, which includes new automotive-operated war plants and all manufacturing activities. It shows that average weekly wages of automotive workers during April totaled $54.37. A later figure shows that the increase in employment from April has been accompanied by a slight rise in weekly earnings in May to $54.89.

This trend toward bigger paychecks for workers has been evident throughout the entire war period. In March, 1939, six months before the outbreak of hostilities abroad, figures compiled by BLS show wages of automotive workers were $30.87 per week.

One year later, employes in motor plants were taking home a weekly pay envelope of $35.53. At the same time the cost of living made only a slight advance, thus the actual buying power of the average weekly wage—using March, 1939, as the starting point—was equivalent to $35.28.

By 1941, weekly wages had continued their climb, reaching what was then an all-time high of $40.61 on March 15. Cost of living, however, also advanced in the 12-month period, but offset the boost in wages only in part. So that in terms of consumer goods that could be purchased, the average wage was still worth $39.76.

Nine months later, just after the attack by the Japanese at Pearl Harbor, average weekly wages were $40.97, but higher cost of living served to decrease the dollars purchasing power. The average pay envelope in the middle of last December could buy $36.75 worth of goods and services, when measured in terms of cost of living in 1939.

It was at this point that the rise in wages pulled away from rise in cost of living to give workers their greatest buying power in history. The advance from $40.97 to the latest available BLS average of $50.29 last April totals $9.32 in actual wages, while purchasing power has jumped from $36.75 to $43.30, or $6.55 a week.

Tribute Paid Engines Of Motor Industry

Many Air Victories Scored in Far East

FINAL PROOF of the superiority of American military products comes when products get into action.

In the capable hands of American aviators, airplane engines from the automotive industry have far outclassed those of the Japanese in the battles over the Burma Road.

An American Volunteer Group, commonly known as Flying Tigers, has set an unprecedented record in the Far East—knocking more than 300 Japanese planes out of the sky and destroying 100 or more on the ground.

On the other side of the ledger, only 15 pilots have been lost.

Flying planes with engines which an automotive firm began developing in 1930 and has been producing for three years, this group of precision experts was formed by Brigadier General Claire L. Chennault and has been in action since only last December under the banner of Generalissimo Chiang Kai Shek.

Just recently the fliers were taken into the U. S. Army Air Corps and now are flying under American colors for the duration of the war.

In a recent message to the plant where they are being built, General Chennault said, "the performance of these engines has been absolutely amazing under the most gruelling wartime fighting conditions. Excellent quality of workmanship and materials has made possible the outstanding performance of these engines in their dogfights with the enemy . . ."

AUTOMOTIVE WAR PRODUCTION

l. 1 No. 5 Published by Automotive Council for War Production August, 1942

Motor Plants Combat Material Shortages

Automotive Industry's Foremost Talent Being Applied to Saving Critical Metals for War Production Needs

"MAKE more and more with less and less."

With that urging, Donald M. Nelson impressed upon his listeners in Detroit last month that America's materials cupboard was getting bare.

"We are short of materials all along the line," the chief of the War Production Board told members of the automotive industry.

Even as he was speaking the seriousness of Mr. Nelson's message on the materials situation was being driven home to automotive war plants in numerous communities. Unable to make axles because it was short of alloy steel, a forge plant closed. Thirty-five miles away, one of the largest producers of military vehicles was forced to limp along with 50 per cent of its axle supply. Finally it had to close down half its assembly lines.

In another case, an automotive plant making airplane propellers was unable to get certain forgings. Affected was only one small part—a tube used for oil testing—but for want of the part, conveyor lines clanked along virtually devoid of finished propellers.

For lack of steel, one of the largest producers of guns cut down its work week from seven days to six, and revealed it might have to drop to five if the shortage continued. Because of the tight situation, a machine gun factory suspended operations in some departments. So it went, affecting plant after plant that heretofore had escaped the sad predicament of empty materials bins.

Reasons for the situation are many. For one, this is the world's first "Alloy Steel War." In peacetime, alloy steel demands amount to only 7 per cent of the nation's steel production; now the percentage is climbing to 20 per cent of total capacity.

Naturally needs for all materials have greatly expanded. One automobile company, now making air-cooled engines for tanks and planes, is consuming nine times the amount of steel used in 1938, the last pre-war year. It's aluminum

(Continued on Page 7)

Automotive Industry Sending Key Men to Fronts to Insure Proper Performance of Motor Products

These men will maintain automotive war products on far-flung battle fronts.

THE AUTOMOTIVE industry is helping the United Nations establish a "third front," an Army of maintenance experts to keep the tanks, trucks, and planes in tip-top shape.

The men for this world-wide Army are recruited right at the motor plants, where the cream of the nation's mechanics is found. It's not a young man's army necessarily, since the automotive companies specify experience as the prime qualification. Many of the recruits are names famous in dirt track racing circles, in speed boat contests and as airplane pilots and mechanics.

In the case of one automotive company, its men are going into the Army as a separate battalion. In other cases, the automotive mechanics will remain civilians—devoting their time to instructing Army men in maintenance techniques—but will be exposed to as much danger as the men in uniform.

More than 1,000 employes of one of the major producers of military vehicles, shells and other armaments recently applied for enlistment in the Army. Of these 859 were chosen to make up an entire Army Ordnance maintenance battalion for repairing mechanized equipment. More than three-fourths of the applicants were mechanically skilled.

At present, another automotive company is training a group of 24 engineer observers for overseas service. After an extensive eight weeks' course, they will be sent to battlefronts to obtain first-hand information on the performance of the company's war products. These experts will be able to locate weaknesses in equipment and transmit their findings to the factory where the products are being turned out. Or if the trouble is of a minor nature, they will assist maintenance crews in making changes in the field.

Long in production of aircraft-type engines for tanks, one automotive company has already sent several groups of mechanics overseas to teach and supervise maintenance of the engines. Others are en route to battlefronts at the present time, while another group is now awaiting sailing orders.

Liberal salaries are paid by the firm, with traveling and living expenses shouldered by the government they serve. Each man sent into a war zone is also covered by a $25,000 life insurance policy—beneficiaries of which are named by the man.

In conjunction with its training school for Army men, another automotive firm is training and sending its qualified civilian employes to Army camps and overseas as instructors in the maintenance of airplane engines.

The training course is primarily set up to familiarize the men with details of a new engine. Considerable time is given to practicing lectures, slide film and movie presentations, which the mechanics must pass on to others, when they take their place in the field as full-fledged instructors.

Once the training course is behind them, the mechanics are subject to call to the four corners of the earth. Recently two of the men were sent to an Army airfield to look over a couple of planes with automotive-made liquid cooled engines in them.

Suddenly things began to happen. A telegram came through ordering the two planes to join an aircraft carrier somewhere in mid-Atlantic, en route to Africa.

"And, incidentally, send men along who know something about servicing and maintaining these planes," the telegram footnoted.

Looking around, Army officials at the field saw the two mechanics who just came down for the week-end.

"Field service, eh? O. K. Climb aboard. You're needed in Africa."

The men had just time enough to send a postcard to friends asking that they forward shirts, socks and pyjamas.

Yearbook Highlights Automotive War Effort

WITH VIRTUALLY all automotive industry facilities converted to war production, a considerable portion of the 1942 edition of Automobile Facts and Figures is given over to graphic and statistical information on the war effort. The new yearbook has just recently been published and is now being distributed.

A chart in the publication projects the annual rate of production of war equipment for the remaining months of 1942, using the rate and progress to date as the basis for estimates. Barring factors beyond its control, the industry will turn out war goods by year-end at double the annual rate achieved in the highest year of automobile production, according to the projection. The annual rate at mid-1942 had already equaled the best peacetime mark.

While war data have a prominent place in the booklet, the regular series of automotive statistics—production, sales, use, taxation, geographical and occupational distribution of cars, etc.—have been brought up to date.

The new edition of Facts and Figures presents the progressive orders covering the curtailing of production and rationing of sales of passenger cars, a survey of the rubber supply situation, a statement of the nation's highway transportation objectives, and other wartime developments.

New Air-Raid Siren Built by Motor Firm

Mechanical Noisemaker Has Eight-Mile Range

THE DIN OF the city room and the rumble of mechanical presses are traditionally supposed to accustom newspapermen to noise. But in an automotive plant not long ago, a group of news men jumped up from a breakfast table and ran from the room to escape a BIG NOISE.

The roar that penetrated their hand-closed ears came from a mechanical noise maker—a new type of air raid siren—which is the result of the joint research of telephone and automotive engineering laboratories.

Tests have shown that the piercing shriek of the siren can be heard as far as eight miles away in still atmosphere.

The device consists of a siren or modulator, a blower for compressed air, and a 140-horsepower automobile engine as its power source. Mounted on a turn-table platform, the unit can be rotated in a full 360-degree arc. It is designed for mounting on roofs and towers.

The noise is created by high-frequency disturbance of air. The air, under five-pound pressure, is introduced into a chamber at the rate of 2,500 cubic feet a minute. Rushing to escape through small vents which lead into the six narrow throats of the horn, the air is chopped by the blades of a fan revolving at the rate of 4,400 r.p.m.

At full blast the siren turns out 170 decibels of sound at the throat. The intensity of such a shriek falls just short of the 190 decibels which scientists estimate to be the maximum racket capable of being produced mechanically.

The engine is a standard eight-cylinder type automobile power plant, governed to 3,600 r.p.m., but equipped with a planetary transmission which raises the output to 4,400 r.p.m. Engine and transmission are connected through a standard hydraulic drive unit such as later models of passenger cars employed.

A smaller unit, incorporating the same noise-making principles but driven by a six-cylinder 120-horsepower engine, will be produced for use on a portable mounting.

Automotive Plants Develop Methods to Give Worn-Out Tools New Use in War Production

WITH THE HUGE production of war equipment causing a heavy drain on supplies of metals, automotive companies are greatly accelerating their salvage and conservation activities.

For instance, the shortage of cutting tools, which is far more serious than most people realize, has led to development of reclaiming methods that in peacetime would be prohibitive in cost.

An ordinary tap, of the type which you once could pick up at the five-and-ten-cent store, now takes two months to replace. It takes six months to get milling cutters today, and to get such a part as a taper reamer for one standard type machine tool requires three-quarters of a year—9 months.

Thus, the salvaging of tools now on hand becomes a definitely sound practice. For monetary savings are relatively unimportant, when values are measured in terms of life-and-death as they are in wartime.

The method of restoring a worn-out form tool, as illustrated above, costs more than it would to replace with a new tool, but through use of such methods, thousands of pounds of cobalt steel are being saved. Left to right, the photo shows: (1) the original new tool; (2) the same tool worn out and, in normal times, ready for discard; (3) annealed and forged, the tool is restored; (4) machining, heating and quenching produce a new tool; (5) grinding, the final step, restores polished surfaces.

Along with the reclaiming processes, all plants are urging workers to use great care in handling precious tools. Broken tools are conspicuously displayed with dramatic explanations of the cost of such waste in terms of time and effort.

Time and labor are, of course, the chief values to be considered now, but waste can still be measured in monetary values. In such terms it costs $40 for tools to produce one airplane propellor. And for every airplane engine, which requires from 15 to 20 cutters alone, the tooling cost ranges between $800 and $1,200.

100,000 Tons of Scrap Metal Returned by Motor Plants

REPORTS TO THE Salvage and Conservation Committee of the Automotive Council for War Production show that automotive plants sent 101,900 tons of scrap metal to mills and smelters in the first month of the industry's salvage drive.

Iron and steel accounted for 97,500 tons of the total, while the remaining 4,400 tons were non-ferrous metal. Unreported are the thousands of tons of metal which some companies, possessing their own smelting facilities, recirculated in their own plants.

New Model Tanks, Now in Action Overseas, Surpass "General Grants" in Performance

At Fort Knox, Kentucky, one day last Spring a small group of enlisted men of the United States Army's Armored Force volunteered for an unspecified mission. All of them were expert tankers, especially proficient in the use of the M-3 medium tanks which, called "General Grants" by the British, were then being produced by workmen who had just been transferred from motor car manufacturing operations.

Though Americans had reasons for confidence in the General Grant tanks because of the speed with which former automotive craftsmen were beginning to produce them, little was then known about the quality of these weapons. The testing of that unknown factor was the task of the Fort Knox volunteers.

Shortly after their arrival in Egypt, they were in the thick of battle in Libya. After a month of almost continuous action they got out of Tobruk, just two days ahead of Marshall Erwin Rommel's arrival.

Late in July they returned to Fort Knox. The first group of United States soldiers to participate in action against the German army, they came home, sun-bronzed and full of that quiet confidence which distinguishes the veteran. Sergeants, corporals and privates, each man was advanced one grade and returned to his command. Slipping quietly back into their jobs, they began to tell their interested bunk mates about their experiences.

The General Grant tank, according to these experts, is a good weapon. The three which they operated came out of battle intact after having destroyed or crippled nine German tanks. Though the riveted hulls had sustained several shell hits, no rivets had bounced around inside, and the tank crews had come out of battle without casualties.

True, there were faults. In one action an incendiary bullet wedged itself into the crevice between the revolving turret and the hull, and the tankers had to use a blow torch to unfreeze the turret. Also, the 75 mm. gun was not as effective as it might be if mounted in a freely-rotating turret on top.

But, these experts reported, the General Grant proved to be capable of "dishing it out and taking it." In addition, they said, it was easy to repair for quick return to action.

According to Maj. Gen. Levin H. Campbell, Chief of Ordnance, the M-3s were the best tanks to see action in the Libyan desert. "They were good enough to stop Rommel," he adds. "It wasn't the Nazi 88 gun that beat the British in Libya. It was the tactics."

Good news to these veteran tankers was the report that a still better tank had started to roll off American assembly lines during their absence.

THEY RUMBLE

Tanks for Land and Wat
Assembly Lines of Auto

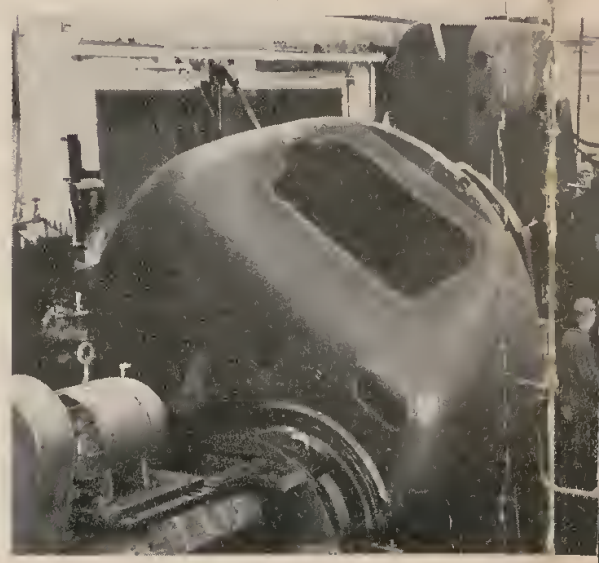
This new model is the M-4 medium tank which, already called "General Lee" by the tankers, is a fast, low-lying mobile fortress with an all-welded hull. Unlike the General Grant, it carries its 75 mm. tank killer in a cast armor steel turret which, perched atop the vehicle, can be revolved to any compass point by electric motor. The crevice between hull and turret has been protected with a collar to correct the defect which the veterans of the Libyan campaign had reported.

Though the first General Lee rolled out of an automotive plant only six months ago, the tankers are already referring to their new weapon as "a tough baby," and trainload lots of M-4s are rolling weekly from the assembly lines to the armed forces.

The first call for the new type tanks came in January, when the Army awarded a contract to a former manufacturer of automobile bodies. To prepare themselves for their novel assignment, this company's craftsmen visited the tank arsenal where another automobile manufacturer had been turning out M-3s for a year. From the men who had been their competitors until recently the first lessons in tank manufacture were quickly learned.

Adapting these lessons to their own

Automotive-developed method of two machines w



AND ROAR

er are Rolling from motive Companies

requirements, these workers set up, in a hastily cleared section of their company's body shop, an experimental production and assembly line. On this make-shift line they built their first welded tank—in 47 days. Here they mastered new skills and techniques while a new plant was being built for mass-production of tanks in the rural outskirts of their community.

By the end of July, when the orginal automotive tank plant reached the end of its production schedule of M-3 tanks, its workers had learned the new techniques for the production of M-4s to such an extent that the change-over was accomplished with scarcely a pause in the assembly lines.

Thus, since Pearl Harbor, a new and vastly improved design of tank and the techniques of its mass-production were developed. And thus, since the first group of American tankers went out to test their weapons in battle, a better weapon was not only perfected, but a mammoth plant for its production was rushed to completion.

Utilizing the techniques developed in this plant, several former manufacturers of automobiles are now contributing to the swelling stream of these powerful machines moving out to attack the Axis on many battlefronts.

orking on one turret speeds tank output.

Amphibian Tractor Provides U.S. Leathernecks With Versatile Weapon for Coastal Invasions

WHILE Hitler for more than two years has bellowed empty threats about "secret weapons," the first completely new tool of warfare to have made its bow in the present conflict has been quietly introduced in the United States.

This tool, which its inventor calls the "Alligator" and the U. S. Marines call their "Invasion Taxi," is an amphibian tractor that is now being produced in the plant of a former manufacturer of motor cars.

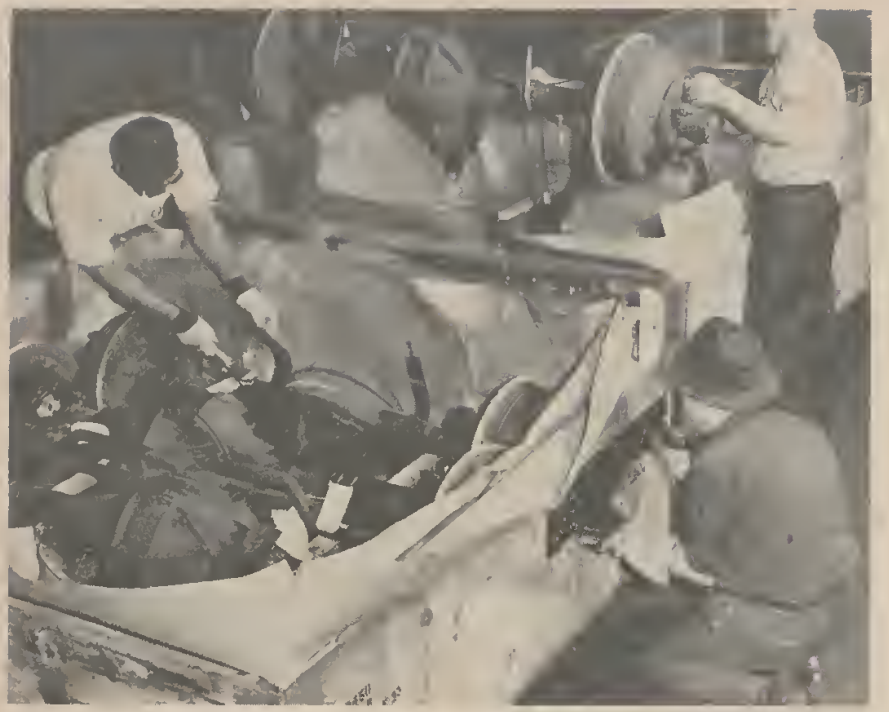
Like the airplane, the caterpillar tractor and barbed wire, all of which were useful U. S. inventions which Old World minds twisted into weapons, the "Alligator" was designed originally as a means of expansion rather than extinction of human life.

The Florida hurricane of 1933, which swept across the Everglades leaving victims marooned in the marshes which no vehicle could penetrate, promoted the invention of the amphibian tractor. After six years of work, the "Alligator" waddled from the inventor's workshop, as a strange mechanical creature that could travel on water, through swamps, and on dry land with equal ease.

As a humanitarian rescue vehicle it was a success. But meanwhile, war had broken out abroad and U. S. Navy observers gathered on the Virginia coast in 1940 to see it tested. Here the 'gator paddled through the water, propelled by caterpillar blades rotating with power supplied by an ordinary automobile engine. On land, metal blades swept the vehicle forward at an increased speed. Seeing the tank slice through tangled underbrush, claw its way out of mud holes and bowl over trees, the Navy ordered the vehicle for the Marines. Here was a made-to-order invasion taxi, able to be carried aboard ship and to be launched overside by sling and boom with a group of Leathernecks ready to ride up to hostile shores.

A faster, improved model of this jungle jalopy is being turned out by automotive workers, who find the job of putting it together one that's made-to-order for their talents. While weeks were consumed in devising special fixtures to hold the large-size steel plates, once the tooling was accomplished the rest of the job was comparatively easy, for the welding techniques are similar to those used in automobile manufacture.

The big difference is in the naval terms used on the job. The workmen speak of "laying the keel" for the tractor, "putting on the pontoons" and other salt-air expressions. Tests are made on the shores and water of Lake St. Clair, just northeast of Detroit. The amphibian has been able to best Michigan's marshiest ground with ease.



Shipping Spare Truck Parts All Over World Demands Efficient Methods of Packaging

WHEN TROOPS on the docks at Alexandria, Basra or Darwin see a load of boxes—249 of them—come swinging over the sides of ships, they know that a year's supply of replacement parts for 100 military vehicles has arrived.

With the ability to make quick repairs in the field so vital in today's warfare, automotive companies many months ago began studying ways and means of shipping parts overseas. Protection was needed from the bitter cold of Russia, the intense heat of Africa, torrential rains of the tropics.

Unique methods of packing have now been developed, meeting these and other requirements, and nothing less than destruction of ships can stop the parts from reaching their destination in usable condition.

Following is a brief description of one of the methods now in operation:

A total of 34,000 parts go into the 249 boxes to make up the full complement of a 100-truck unit. Eight distinct steps are required to keep each precision part perfectly clean and to protect it against moisture. A special solution is even capable of absorbing the self-generated moisture of the metal.

When the wooden boxes are finally strapped shut, the contents of the boxes are so well protected that should they be dropped in salt water, the parts would remain unharmed.

If a motorized column moves up into action, it is not necessary to haul the extra parts along, for the packaging system allows the boxes to be buried in the ground. Trucks knocked out of battle can then be returned, parts dug up, and repairs made.

Easy identification is made possible by placing metal tags on each box, listing the parts contained therein.

To reach accord with our allies, who will be receiving the parts along with our own troops overseas, a meeting was held to discuss details of the plan.

"Our men won't understand your terminology on a number of parts," a representative of the British government told the packaging engineers. "We call hoods, bonnets; fenders, guards; windshields, screens," he explained.

Both the Russian and Chinese representatives agreed that their people were more familiar with the British nomenclature, so all such parts are now referred to in that manner.

When the contents of the wooden boxes are depleted, hinged lids allow them to be converted to medicine kits, food containers or ammunition boxes.

Automotive Techniques Save Time, Materials

Steel, Copper Diverted To Other War Uses

EVERY OUNCE of metal, every precious second of time assume importance today, all out of relation to ordinary values.

In wartime, savings of even small quantities of materials may mean the difference between production and shut-down. And savings in production time may allow another gun, another tank to get to the fighting front.

In the automotive industry today, no possible way to save time and materials is left unexplored. By doing away with solid forgings employed in making parts for anti-aircraft guns, a former motor plant saved 2,500 pounds of steel per month. Steel stampings, similar to those used in automobile frames, replaced the forging and did away with 14 time-consuming machine operations.

By welding parts together—another established automotive practice—instead of using alloy steel forgings, the same automotive engineers cut three hours off the machining time of another gun part and saved 25 tons of steel a month.

Shell cases made of steel, rather than hard-to-get copper and zinc, are now coming from another automotive factory. Saving of millions of pounds of copper will result.

To make a machine gun part, manufacturers once started out with a 4-inch steel tubing, weighing 20 pounds, and machined it down to size. Now automotive firms take a pearlitic iron casting weighing 6 pounds and take off only a pound-and-a-half of metal. Man-hour requirements are cut 50 per cent by this new automotive development.

AUTOMOTIVE WAR PRODUCTION

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HARRY A. WILLIAMS, Editor

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Automotive Industry's Foremost Talent Applied To Saving Critical Metals for Production Needs

(Continued from Page 1)

consumption has increased eight times.

War plants are getting into production ahead of schedule, thereby devouring tons of materials months before they were slated to use them. Boatloads of materials are assigned to lend-lease. And, in America, shelves are stacked today with materials that will not be fabricated and assembled until month-after-tomorrow. This, of course, aggrevates the supply shortage. A similar situation could develop on Main Street if, on Monday, a large number of housewives filled their kitchen bins with flour for Saturday's baking. The local stores would have a hard time accommodating customers who, wanting to bake on Tuesday, had waited until that day to make their purchases.

The automotive industry has never operated with large inventories of parts and materials on hand. Factory space limitations would permit scarcely more than a day's supply of one item, a week's inventory of another. The key to mass production was a balanced, planned and controlled flow of materials. It resulted in the right piece of equipment being on hand for the assembly worker when he needed it. It required that every item come in on time. But it didn't mean that parts could be fabricated and piled to the roof tops while awaiting assembly. It didn't mean acquiring materials in huge lots, but rather on an "as-needed" basis. It demanded control of inventory, particularly at the end of a model run, when a surplus of parts and materials on hand meant economic loss.

Operating under the priorities and allocations system, automotive war plants have no such control over their material needs. Like all other manufacturers, the automotive plants must try to get materials assigned to them for so many units of some specific war product. Yet the number of items a plant makes this month may be more or it may be less, depending on the materials allocated to it. This results in unbalanced inventories, an oversupply of fabricated parts here, not enough parts there. The "ideal" situation, of course, would be to know the total requirements for any one product and to plan for sufficient materials to meet these requirements. In that way, a regular flow of raw materials could be organized, keeping a minimum "float" on hand and in transit.

But this is war. And ideal situations are rarely achieved in wartime. Knowing that, Donald Nelson urged the automotive industry in July to "continue to be ingenious. Never for a moment let up in your search for ways of doing more, faster, with less."

The automotive industry already was well embarked on a campaign to save materials for the nation. In June of this year, more than one hundred thousand tons of metal scrap started on its way to the mills and smelters from automotive plants.

And for many months, more than 400 of the industry's top flight engineers and technical experts—drawn from all automotive companies—have been breaking materials bottlenecks by pooling ideas, developments and inventions. The work of this group, plus contributions by individuals in automotive plants, is resulting in new materials, new methods, new designs.

And while the overall problem is far from solved, the fact that the automotive industry is delivering $12,000,000 of finished war products each day to the fighting forces is evidence that progress is being made.

Mobile optical shops: Another vital use of motor trucks in wartime.

Motor Trucks Provide Optical Repair Shops

Units to Accompany Troops Into Field

SOLDIERS WHO lose or break their spectacles in the field will now have them immediately replaced or repaired by mobile optical shops, the first of their kind to be attached to United States field armies.

The first of these truck-mounted units, designed at the request of the Surgeon General's office, contains optical machinery, 36,000 lenses, 8,400 frames, 600 pairs of extra temples, and 1,200 spectacle cases.

With this equipment 120 single lenses can be edged and mounted daily. It is estimated that each such unit can take care of the average requirements of a field army of 300,000 men.

In World War I, the loss or breakage of glasses was a serious matter in the A.E.F. Since the Army's only optical shop was a stationary one in a Paris suburb, the soldier whose glasses were lost or broken in line of duty was a "casualty" until his loss could be taken care of through long and circuitous regulation procedure. More often than not, such "casualties" hunted up a civilian optician and paid for the replacement out of their own pockets.

Since about 15 per cent of the men wear glasses in the present war, the motor truck has been adopted for this novel war-time use. As each soldier has a copy of his prescription attached to his service record at headquarters, his emergency needs can be taken care of immediately after he reports them.

WORKERS' SUGGESTIONS SPEED WAR PRODUCTION

Yankee Ingenuity Helps Overcome Job Bottlenecks

THE YANKEE mechanic has his dander up, and it spells bad news for the Axis.

Normally a peace loving citizen, the ingenious, resourceful, whittling American workman is backing up his aroused anger over Hitler and Hirohito's misdeeds with specific contributions to the battle of production.

Ideas originating with the man on the machine are being funneled into committees of experts in automotive plants for study. Hundreds of such ideas, tested and their application proving practical, have resulted in increased production, improved quality, reduced costs and savings of material. Here are a few:

One ingenious worker put a false bottom in the carts which pick up oil-saturated scrap shavings from machines, thus allowing the precious cutting oil to seep through to the real bottom. This eliminated the previous large lubricant losses when the chip wagon was dumped.

An employe who had the tedious task of removing surface blotches from aluminum sheets, suggested a new-type tool which could be used in an electric drill. The same job is now done in 10 per cent of the previous time.

Designing and building an extension shaft for the compressed air grinder which he used on his job, another automotive worker was able to make a considerable reduction in grinding time and also save large amounts of vital materials, since many of the grinding wheels were eliminated entirely.

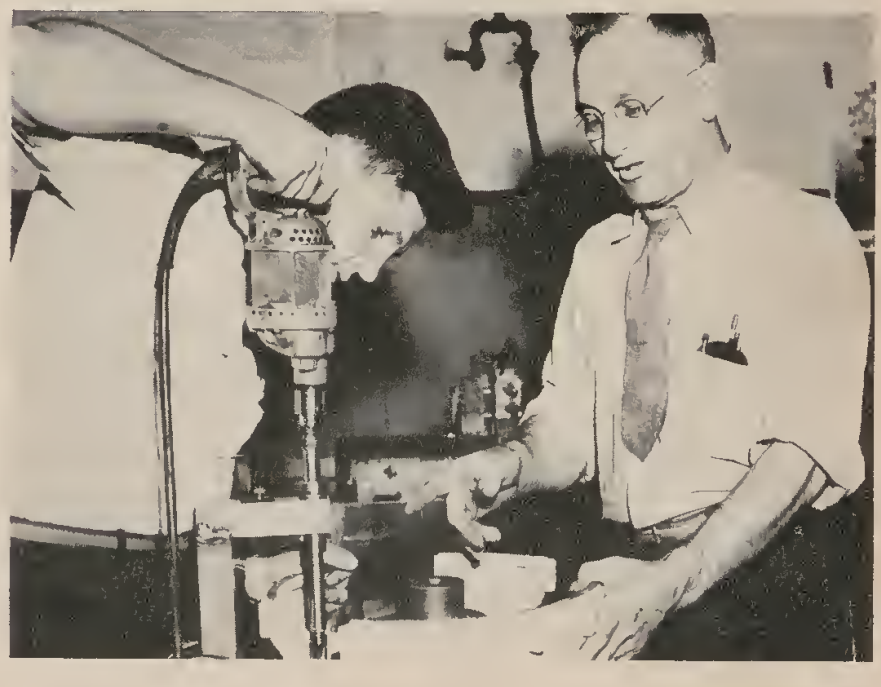
On an aircraft job involving numerous hand-filing operations, an idea was submitted by a worker to sand blast the hundreds of files which the company was forced to discard after a short period of usefulness. Investigating the idea, the company discovered that a certain sand-blast method would restore the files and they are now being used over and over again.

Accustomed to burring an aircraft engine gear by hand, an automotive worker designed a special drill to do the job automatically. The same amount of work that previously took five hours is now being accomplished in one.

A suggestion that a machine operation might replace hand filing of an aircraft part has enabled one automotive company to clip 20 minutes production time from each part.

For these ingenious suggestions, workers in some cases are being rewarded with war bonds, running as high as $1,000. Another system encourages workers to file patents on those ideas which are of a patentable nature.

Worker points to machine that he suggested to replace hand operation.



AUTOMOTIVE WAR PRODUCTION

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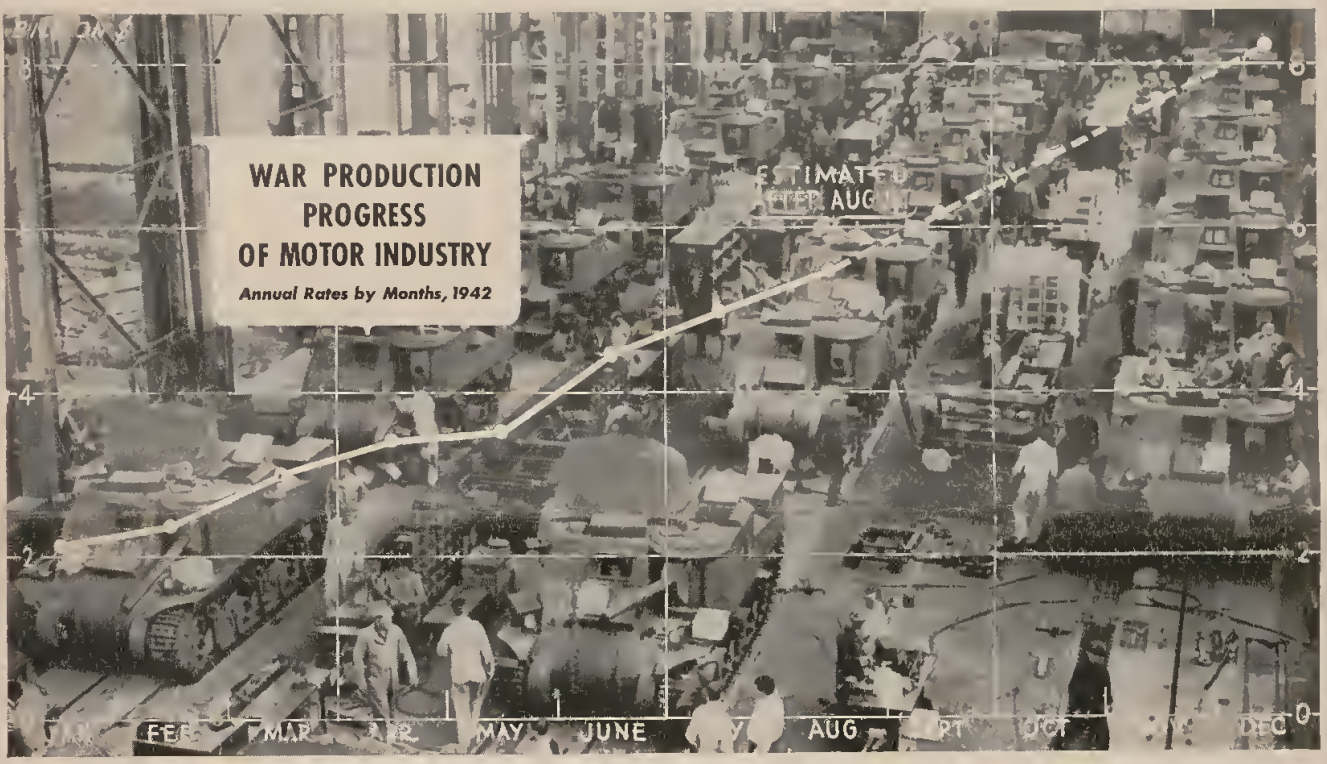


WAR OUTPUT EXCEEDS BEST PEACETIME RATE

Automotive Industry Payrolls 20% Above 1941
While Annual Production Pace Jumps 32% Higher

PRODUCTION and employment in the automotive industry now are substantially above the highest levels ever attained in peacetime. Currently the industry is producing weapons of war at an annual rate of $5.4 billions, or 32 per cent ahead of the average rate of production of non-military items in 1941—the peak peacetime year of the automotive industry.

Payrolls of automotive plants have been rising rapidly, with upwards of 40,000 new workers being hired monthly. In August, it is indicated by partially estimated figures covering 772 motor vehicle, body, parts and tool and die plants, there were 809,000 employes engaged in turning out munitions.

That total is more than 20 per cent above a year ago and 6 per cent above the previous high point in May 1941.

Further, barring shortages of materials and manpower or other factors beyond the industry's control, current uptrends will continue for many months.

Commenting on the industry's record thus far, Alvan Macauley, president of the Automotive Council for War Production, declared: "In view of the fact that this excellent progress has been made in a period that generally was one of bringing new facilities into operation, of retooling or converting additional automotive production equipment and of training workers in new skills, the record becomes even more impressive.

"We all know, however," Mr. Macauley said, "that the real test of the industry's ability to produce still lies ahead of us. Thus, it is highly encouraging that throughout the industry, from newest trainee to most seasoned executive, there is a steady and growing conviction that what we have produced to date is an indication that infinitely more can be produced. While the production accomplishments have been superb, no man in this industry will be satisfied with the industry's production peaks—no matter how high—so long as our fighting forces and those of our allies need one more gun, one more tank, one more engine."

The annual production rate of $5.4 billion, estimated for August, is equivalent to daily deliveries of $14.5 million in aircraft, ordnance and naval equipment. The daily rate in July was $13.6 million.

(Continued on Page 6)

Manhours Required to Make Aircraft Prop More Than Double That of an Automobile

HYDROMATIC, variable pitch, full feathering, three-way aircraft propellers.

Sound complicated? Well it is.

Four full days are required to complete a propeller. Two-and-a-half times as many man-hours as formerly required to turn out an automobile are expended. That's why mass production of propellers can be classified as one of the more difficult jobs undertaken by the automotive industry.

"What takes all the time?" laymen ask. "Aren't propellers merely blades joined together on a central drive shaft?"

Well, in the hub of the propeller alone are more than 100 parts, fitted together with watch-like precision. Each of the parts is put through from two to two hundred machine operations and each must be perfectly balanced to give the necessary performance. In addition, scores of hours of hand work are required in this delicate job.

One of the reasons all these parts are necessary is that this type propeller has blades with a variable pitch which permits the engine to deliver a constant specified power automatically under all flying conditions—actually the gear-shift principle applied to airplanes.

In addition, the new hydromatic model permits "quick feathering" in case of motor failure. This allows the blades to be quickly turned edgewise to the air stream, thus cutting down on air resistance and increasing the performance of the remaining engine or engines. In case of a crackup, it also tends to reduce damage to the propeller.

All the mechanism for the pitch control and feathering is contained in the hub and is sealed. All moving parts are lubricated by oil, which is circulated around the hub under pressure.

The job was so tough that before the expanded needs of war, all propellers were turned out by hand. Mass production was considered impracticable. But by combining both methods, the automotive company has been able to meet the requirements and is turning out propellers in carload lots daily.

In applying paint to the propeller blades a process, formerly used in automotive building days, has reduced production time from hours to minutes. Moving individually through a spray bath, each blade is then carried by overhead conveyor into an infra-red drying oven. This method now dries the paint in four minutes, whereas air drying required 48 hours.

Inspections required to insure perfect balance consume much time. After each machine or hand operation, the part must be moved to a bench for testing. Blades are measured minutely at positions of three or four inches over their entire length.

If any of the parts or blades are the slightest degree off balance, they must be corrected before moving to the next operation. When in balance the whole 410-pound completed assembly can be moved by a puff of the human breath.

Should the final assembly be out of balance, four holes are provided on the barrel between each of the three blades. Into these, workers can add a small quantity of lead wool, a few threads at a time. The margin of correction is so slight, however, that if all holes were completely filled only three-tenths of a pound would be added to the weight of the entire propeller assembly.

Propellers are coming off automotive assembly lines in carload lots daily.

Automotive Equipment Scattered Over Nation

9,000 Production Tools Relinquished by Plants

NEARLY NINE THOUSAND machine tools, presses, welders and other pieces of production equipment have been taken from automotive plants in the last seven months and scattered throughout the nation.

Gone are the presses shown standing in a yard covered with snow, made famous last winter when the automotive industry was converting to war production. Several of them ended up in Wheeling, West Virginia.

Another former automobile manufacturing company opened its press room on a "come one, come all" basis, turning over this giant equipment to anyone who could prove he would use it in war production.

A ship building company in Mississippi took over the welding equipment of one automobile body company.

And a number of sewing machines once employed in automotive upholstery work now are being used by Japanese! The State Department was the purchaser in this case, buying up the sewing machines for shipment to eastern California, where the re-located Japanese are making tents and tarpaulins for the United States armed forces.

Through the Machine Tool Listing Service of the Automotive Council for War Production, many exchanges of productive equipment have been effected. A factory in Massachusetts, for example, having proved to the Army and Navy that time could be saved by stamping a bomb sight part which was formerly machined, found the required presses in the Detroit area after a futile search of all machine stores east of the Mississippi River.

Also in Detroit, the Service uncovered 50 coining presses—lack of which was holding up production of more than half-million 37 and 40 mm. shell blanks daily. An automotive company discovered that coining resulted in a far superior cartridge case and, submitting the idea to the Army, was ordered to adopt the method on all future shells.

In the first six months, the Council listed almost a quarter of a million machines in 442 plants of 259 motor vehicle, body, parts, tool and die firms.

70 Mile-an-Hour Mobile Artillery to Head Onslaughts Against Enemy Tank Columns

ON 108,000 bumpy acres of Texas a group of Army experts have been perfecting the tactics needed to best utilize a new military weapon.

The weapons, called TDs by the men who are developing methods for their use, are variously described as mobile cannon, combat cars, trackless tanks, etc., but are more accurately tank destroyers.

Capable of speeds up to 70 m.p.h., these motorized vehicles travel on multiple wheels. Lightly armored, they are heavily armed. Their guns, in several calibers, are mounted to fire forward in the direction of travel. Basic weapon at the present time is a 75 mm. gun.

Several former manufacturers of automobiles and trucks are at work on production of these weapons which, though new to the U. S. Army, are of a type which the armies of the U.S.S.R. have been using with deadly effectiveness against Nazi tanks. Another prototype of the weapon is the self-propelled 88 mm. siege cannon which the Germans introduced in the Polish campaign and with which Field Marshal Rommel ambushed a British tank force in Libya at the start of his drive into Egypt.

This charging artillery has been developed because ordinary artillery leaves much to be desired in fighting tanks. Being mobile, tanks do not stay put until ordinary artillery can get set to attack them. Frequently in this war, tanks have swept around big guns and cut them off from behind. Although guns towed by fast trucks or half-tracks have been adopted, they cannot go into action until they are unlimbered and turned around.

Tank destroyers operate in three vehicle teams comprising two gun mounts and their own protective anti-aircraft carrier. Camouflaged, they easily out-race their 30-m.p.h. foe and either lob shells from five miles away, with the help of small low-flying airplanes to direct their fire, or they can sweep in close, take a devastating crack at short range, and run for cover.

To the little group of U. S. Army men who are developing the tactics of the vehicles' use, speed and fire-power are the substitutes for armor. As one of them explains the tactics: the idea is to catch your adversary sitting in his corner with his back turned, hit him behind the ear with brass knuckles, and then run full speed to a new position for another sneak punch.

Reports from the battlefields about the TD battalions should not long be forthcoming as the first group has already completed the course and has moved on, making room for new battalions who will be similarly trained.

POWER FOR THE NAVY

●

Thousands of Marine Engines for Stealthy Sea Raiders Made in Automotive Plants

British raid on Norweigon coast destroys Nozi oil tonks. British Ministry of Information pl

SOME OF THE MOST effective U.S. Naval activity in World War II is being rendered by small craft—barges, tug boats, patrol boats—which are now rolling out of shipyards which only a few months ago made pleasure craft.

The automotive industry is supplying marine engines for these, as well as for bomber loading boats, picket boats, fishing boats and others.

Such vessels may sound like small fry, but remember:

The U.S. Marines recently drove the Japs out of Guadalcanal in the Solomon Islands, taking over newly laid airfields and capturing Jap supplies. A fleet of landing boats—equipped with automotive-built engines—was used to storm the beach.

The commando raid on Dieppe was made possible by small British boats similarly equipped.

In late 1941, when the British made the daring attack on the Lofoten Islands, special landing craft with automotive marine engines were used. During this highly successful raid, oil plants were put out of action, oil stores burned, prisoners taken and large numbers of Norwegian volunteers brought back to fight with allied forces.

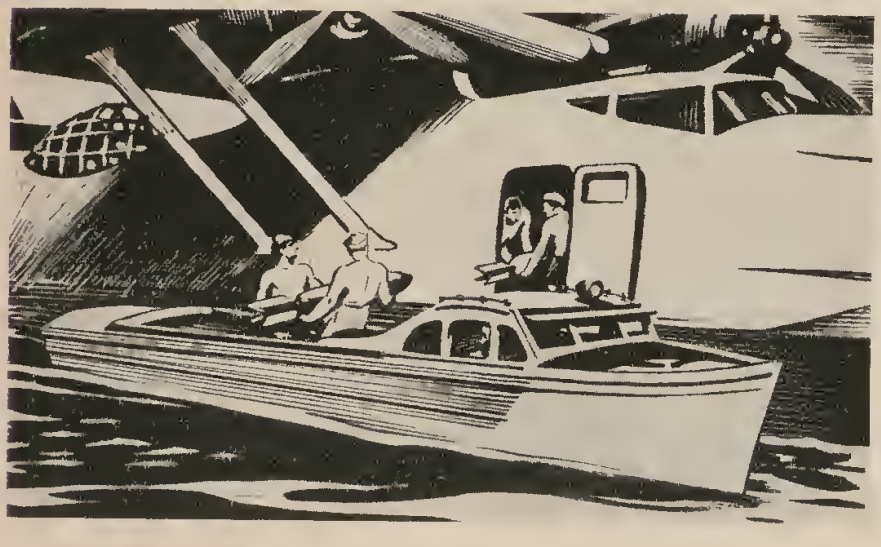
The small patrol and picket boats are in action daily, sharing with sub-chasers, patrol planes and blimps the responsibility of combing Amercian coastal waters for enemy submarines.

By using automotive-built engines, the Navy is able to get more mileage out of its gasoline supply, an important factor in these days of hazardous maritime transportation. In a recent test, for example, a 65-foot boat was tested over a 100-mile course, first with its original six-cylinder engine, and then with an eight-cylinder engine built by an automotive company. Traveling the same course at identical speeds the automotive engine consumed 64 gallons less than the original engine.

Both six and eight-cylinder engines are going into the small craft. These are of the high-speed automobile types, the principal variation being in the use of reduction gears to lower the revolutions per minute delivered by the engine. This is similar to the use of reduction gears on steam turbines, which has proved so successful on large ocean-going vessels. Without their use, engines would spin propellers so fast that most of the water would be removed from the path of the blades, leaving nothing to "bite" on.

Also contributing to maximum propulsion power is the use of proper size propellers. With the size of the boat the determining factor, the automotive company has established definite specifica-

Automotive-mode morine engines power bomber-looding boots.



Navy surf boats maneuver into position, prior to taking on troops. Official U. S. Navy photo

● Small craft prove big factor in raids on Solomon Islands, Dieppe and other enemy shores. Patrol boats, also powered by automotive-made engines, comb coastal waters for submarines of Axis powers.

tions on the size of propeller blades, as well as on size of reduction gears.

Despite the fact that these engines are small, their propulsion power is sufficient to handle tough jobs. Used in tugs, for instance, they are moving 8,000-ton Army transports around docks with ease. In bomber loading boats, they are hauling 8,000 pounds of bombs out to sea, where large Navy planes drop down and take on new supplies of deadly missiles.

Recently an automotive company was given orders for engines needed to build up fishing fleets. Many fishermen converted their ships to other uses when the war broke out, with the result that today the demand for fish is exceeding supplies. Due to the lack of fishing boats, an acute shortage of medicine and vitamins obtained from the oil of sharks' livers was developing.

War production has so greatly accelerated shipping on the Great Lakes, that these automotive-type engines have been installed in a new-type water tractor for hauling barges or scows. This will enable many tug boats—of which the supply is limited—to be used in other work. The tractors can be hooked directly onto hull structures, thereby giving scows the maneuverability of independent vessels. They are capable of speeds equivalent to those of ordinary tug boats.

In addition to power plants for these small units, the automotive industry is supplying many other types of marine equipment for the United States, British and Russian Navies.

The spectacular PT boats of the U. S. Navy, for instance, are powered by super-marine engines which have been rolling from one company's assembly lines for the past three years. Three of the engines—each developing more than 1,300 horsepower—supply the power for these compact fighting craft, which possess a battle complement of deadly torpedo tubes and a battery of anti-aircraft guns.

The speed of these units enables the Navy to get in close, loose torpedoes, and dash out of range of enemy fire. These tactics were used by Lieut. John D. Bulkely and his squadron in the successful encounter with the Japanese off the coast of Cebu. General Douglas MacArthur made his roaring departure from Bataan in one of these boats.

Another automotive company, that has been producing Diesel engines for the past nine years, is now making half the Diesel engines the Navy uses. Recently developed was a new engine that is only one-third the size and a fraction of the weight of former Diesels of the same horsepower. A new type propeller, whose blades can be adjusted to any angle or can be completely reversed while the boat is in motion, provides greater power and maneuverability than has ever before been possible in other than small boats.

Still another motor company has taken on a large subcontract for marine engine parts. Connecting rods, engine blocks, crankcases, cylinder heads, etc., are being turned out in quantity and shipped to another motor company for assembly into completed engines.

In addition to their roles as suppliers of marine equipment, automotive companies are training the uniformed manpower that is needed to operate, maintain and repair the equipment.

Ensign George E. Cox, who distinguished himself in the torpedo boat action off Cebu, as well as a number of other American, British and Canadian heroes of the mosquito fleets, were graduates of a service school maintained by the automobile company whose factory produced the engines.

Small tugs handle transports with ease.

Motor Industry Payrolls 20% Above 1941 While Annual Rate of Output Jumps 32%

(Continued from Page 1)

Latest analysis of the major war production contracts undertaken by the automotive industry shows that seven companies are building aircraft engines in volume and two others are preparing to produce them; nine are in production on fuselage subassemblies—wings, nacelles, center sections, tail pieces, etc.—and four are manufacturing propellers. In addition, five companies hold contracts to produce complete aircraft of various types and two of these are nearing the end of the tremendous tooling programs involved. (There are already planes in the air that have been assembled completely from automotive-made parts.)

Military vehicles are being made by 29 companies; seven of these are making combat cars, half-tracs, tank-destroyers and other armored vehicles.

Eight companies are making tanks—medium, amphibian, light and special-purpose—with one plant alone turning out as many units as are produced outside the automotive industry.

Marine engines of several types and sizes are in volume output in six automotive plants. One plant alone is supplying more than half of all the diesel engines that the U.S. Navy uses.

Artillery, including aircraft and anti-aircraft guns, tank and anti-tank cannon, field pieces, etc., is pouring from the plants of seven automotive companies while an eighth has nearly completed tooling. Gun carriages, to give cannon mobility, are made by eight companies. The same number of manufacturers are turning out such small arms as machine guns and carbines. In addition, scores of plants are turning out shells and other ammunition, while nearly a thousand plants are subcontractors on the major products enumerated above.

Production of $450 million in armaments last month compares with $414 million in July. This is an increase of $36 million or nearly 9 per cent.

While production rates of individual war products are necessarily military secrets, this $36,000,000 increase is more graphically presented by listing its equivalent in various products, picked out at random. Thus, the production gain is equal to

100 tanks,
plus 50 sets of bomber subassemblies,
plus 100 aircraft engines,
plus 150 marine motors,
plus 1,000 military vehicles,
plus 100 anti-aircraft cannon,
plus 100 aircraft cannon,
plus 100 tank and anti-tank cannon,
plus 500,000 large shell casings.
plus 500 machine guns,
plus more than $3 million in the nearly 300 other armaments produced by the automotive industry.

Monthly figures of employment and deliveries are shown in the table below.

AUTOMOTIVE PROGRESS ON WAR JOB

	DELIVERIES		EMPLOYMENT*	
1942	Actual	Annual Rate	1942	1941
Jan.	$172,734,000	$2,072,808,000	648,000	717,000
Feb.	194,851,000	2,338,212,000	620,000	732,000
Mar.	257,168,000	3,086,232,000	621,000	744,000
Apr.	286,883,000	3,442,596,000	634,000	755,000
May	293,626,000	3,523,512,000	683,000	761,000
June	373,363,000	4,480,356,000	723,000	744,000
July	413,712,000	4,964,544,000	767,000 (p)	710,000
Aug.	450,000,000 (e)	5,400,000,000	809,000 (e)	670,000

*Total workers in 772 motor vehicle, body, parts and tool and die plants.
p—preliminary. e—estimated.

AUTOMOTIVE WAR PRODUCTION

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Automotive Council for War Production

HARRY A. WILLIAMS, Editor

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Army and Navy Honor 42 Automotive Plants

CONFERRED by the Army and Navy in recognition of distinguished service in war production, the "E" flag today is flying above 42 automotive plants and the "E" button is being worn by thousands of automotive workers.

The armed services to date have honored the management and personnel of 198 plants with the citation for excellence. More than 21 per cent of these have been won by motor vehicles, parts and tool and die plants.

Major General Levin H. Campbell, Jr., chief of ordnance, in making one presentation to an automotive company, explained that the "E" is the highest honor industry can win in time of war.

Automotive men generally have stressed the feeling that the "E" merely indicates that a good start has been made on a production job that will grow steadily in future months.

One industry leader declared that his plant's record had been made possible by the teamwork "of hundreds of suppliers in more than 20 states."

Pointing out that formerly competing automotive companies had banded together as one and with a common objective in the Automotive Council for War Production, he said "we have pooled our resources and our know-how to such an extent that perhaps this award should be accepted on behalf of the entire industry."

In addition to the Army and Navy, the War Production Board has also honored the automotive industry. In its first announcement of workers awarded medals for ideas which increased or improved production, the WPB listed 33 awards. Nine of these were won by employes of an automotive plant, which was by far the highest percentage of awards made to any one industry.

Automotive Research "Keeps 'Em Flying"

Spark Plugs Developed For Peak Performance

DISCUSSING AMERICA'S all-out war-plane production recently, an aircraft expert said:

"Think of what it demands. Taking all types, 185,000 planes in two years means . . . approximately 555,000 engines.

"Take the spark plug as one item alone. It means spark plugs by the millions, possibly fifty million.

"And those fifty million spark plugs must not be wrong; or the crew and a flying machine worth up to a third of a million dollars will fail in their mission and be on the casualty list."

Those fifty million spark plugs *will not* be wrong—thanks to a long line of automotive research.

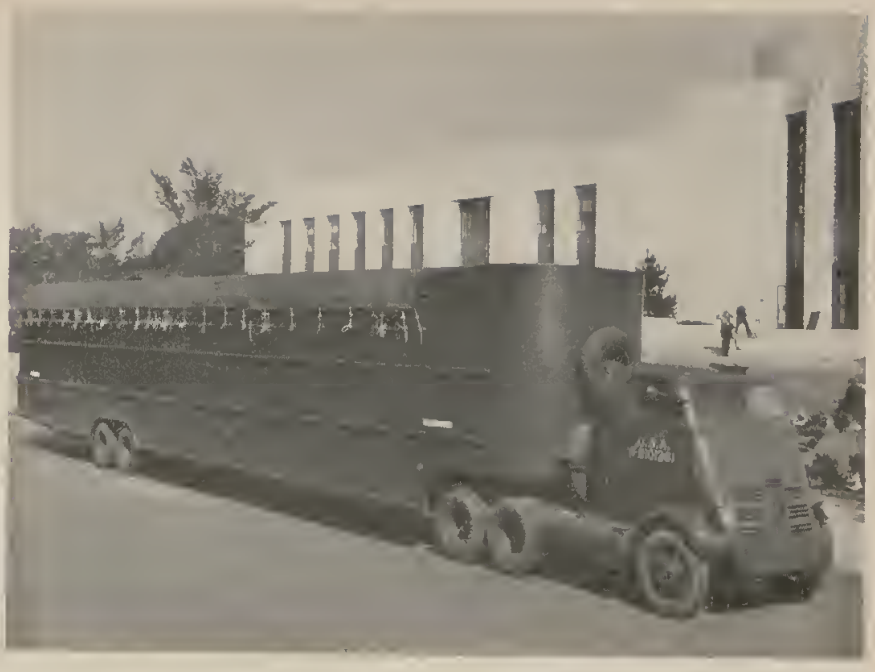
For a decade ago, a group of scientific investigators in an automotive manufacturer's laboratory tried to perfect techniques for making a substance with the qualities of precious stones.

Never in this decade did it occur to them that their research would one day pay off as dividends to the armed air forces of the United States. Yet, their ultimate achievement, like other efforts of the kind, brought rich, unpredictable results.

Recently, out of these laboratory investigations, came a mass-produced spark plug with an insulator second in hardness only to the diamond. Resistant to the destructiveness of lead in aviation gasoline, and able to withstand terrific heat and extreme cold without cracking or becoming leaky, it was tested and found so efficient that the entire output of the manufacturer was absorbed by the U. S. Government.

Though many details of its composition and manufacture are military secrets, it is known that the basic material is aluminum oxide. This oxide, mixed with a binder and squeezed into shape by pressure and heat, is purified by "baking" in a butane-gas-fired kiln. It emerges, with binder burned away, as the stuff of sapphires, amethysts and rubies.

Its chief value to the U. S. air forces in the present emergency lies in the fact that its use in fighting planes will "keep 'em flying" for longer periods by reducing the time formerly required to inspect and replace conventional spark plugs.



Mammoth Trucks Hauling Bomber Parts From Motor Plant to Texas Assembly Line

FROM DETROIT to central Texas is more than 1300 miles—a three or four-day trip by motor car. But an automotive company is scheduling daily over-the-highway deliveries of airframe subassemblies and parts for fabrication into bombers by the Texas assembly plant.

A fleet of 90 trucks, largest units ever used in interstate service, is being built to operate in a shuttle system between the plants of the manufacturer and the assembler. By continuous driving the trip can be made in two days.

The fleet is to be divided into five groups of 18 trucks each. One day's output of the Detroit fabricating plant at peak will require 18 trucks. Operating plans call for four of the five groups to be on the road constantly, while the fifth is either loading or unloading.

The huge truck-trailer combinations are 73 feet, seven inches long and are equipped with five axles and 18 wheels. When fully loaded, weight ranges from 50,000 to 63,000 pounds. Despite the fact that this is well over the maximum length and weight restrictions of many of the states covered on the journey, all have waived border barriers. Some states have even offered to supply police escorts from border to border.

Power is supplied by two high-speed automobile engines under the cab. An ingenious system has been worked out for making quick repairs on the engines. Each is mounted on a slide arm, which allows it to be pulled out in front, clear of all obstructions. If an overhaul is needed, a new engine can be installed in 15 minutes.

Another important advantage of the trucks is the large saving of freight car space. Two of these units are equivalent to seven freight cars. Special design of the trucks also allows them to be loaded in 150 man hours less than is possible when shipping by rail.

Army Horsepower Increases As Trucks Replace Horses

IN 1913, the United States Army purchased 88-million pounds of oats, 126-million pounds of hay—and just 16 motor trucks. At that time there were 21,000,000 horses in the United States. Today, old Dobbin's breed has been reduced to 10,000,000.

Motor trucks, on the other hand, have greatly increased. Even before the present war, motor vehicle manufacturers were producing more than a thousand military trucks a day for the United States and its allies. Before long, it is predicted, half as many American-made vehicles will be in use by allied forces as there are commercial trucks in the U. S.

"HIGHWAY OF FUTURE" BUILT FOR TODAY'S NEEDS

Advance highway engineering pravides traffic separatian far heavily-traveled three-way intersectians.

New Road to Carry Heavy War Travel

VISUALIZED as a highway of some roseate future several years ago, it is now a practical arterial about ready to serve the needs of thousands of war workers.

To relieve traffic congestion around new industrial war plants, a $15,000,000 limited access highway is nearing completion.

The road is a direct route from the city limits of Detroit to the huge new bomber plant 20 miles distant. Encompassing the latest engineering advances, it allows workers to drive directly through the gates of the plant, virtually non-stop from the time they enter the highway. This will considerably reduce traveling time and will ease the problem of tardiness in plants.

Divided lanes provide the utmost in safety on the highway. All intersections, with the exception of two minor ones, are eliminated by bridges and tri-level separation. The latter system, the second of its kind in the country, is provided on two heavily traveled intersections. In these, three levels of traffic are moving at one time, each independent of the other. Not a single traffic light or railroad crossing impedes movement.

With most of the workers at this plant coming from Detroit, the old highways in the vicinity could not accommodate the traffic without considerable congestion. It has been estimated that at shift change periods more than 8,000 passenger cars and 140 buses will be moving in and out of the plant.

In another part of Detroit a $19,000,000 cross-town route is now under construction, which will carry workers through the heaviest congested areas of the city. In one direction it will lead to a new tank plant, a new truck plant, and a new Naval arsenal on the outskirts of the city. In the other, it leads to a new Diesel plant.

Highway authorities contend that roads such as these are pointing the way to a new pattern of living in America. In the past cities grew up around centrally-located industries, with workers pouring from the outskirts to their work in the inner circle. The result was excessive congestion of transportation facilities, causing stagnation and blighted areas in cities.

The new pattern calls for industries moving into the outskirts of cities, thereby reversing the trend. Workers will then be traveling from their homes in a central area to their work outside.

This, it is pointed out, demands road construction such as that taking place in Detroit. Otherwise, when the movement becomes more pronounced in the future, the same congestion that is prevalent today would remain.

In most cases, there are sufficient rural routes to handle the flow of traffic from cities. Therefore, the highway experts say, the urgent need is for more roads of the previously mentioned cross-town route, which is specifically designed to get workers out of the congested areas and into the outskirts. Here the traffic will then disperse in various directions over the many rural routes.

AUTOMOTIVE
WAR PRODUCTION

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America's Fighter Planes Prove Ability in Action

Automotive Industry Helps Build Superior U. S. Air Armada

IN SEVEN distinctly different types and several modifications of each type, the United States now possesses a more versatile force of fighter planes than any other nation, Axis or Allied.

As each type and modification has been designed for specific tasks, American-built fighters have been widely dispersed along the far-flung fronts of the global war.

Thousands of these fighters are now in action; more than two thousand of one type alone having moved from U. S. factories to fighting fronts in the past year.

In each and every one of these thousands of machines that operate day and night over all the continents and fronts from Iceland to Australia, there are vital parts which were fabricated in scores of automotive factories. Such parts include engines, propellers, automatic cannon, machine guns, instruments, as well as a currently expanding list of fuselage sub-assemblies. And, at this writing, a number of automotive plants are projected upon programs for assembly-line production of complete fighting planes.

Recently, a congressional committee was appointed to gather facts about the nation's fighter planes. This was done to investigate battle performances of these craft which were being subjected to criticism in a stream of rumors of mysterious origin.

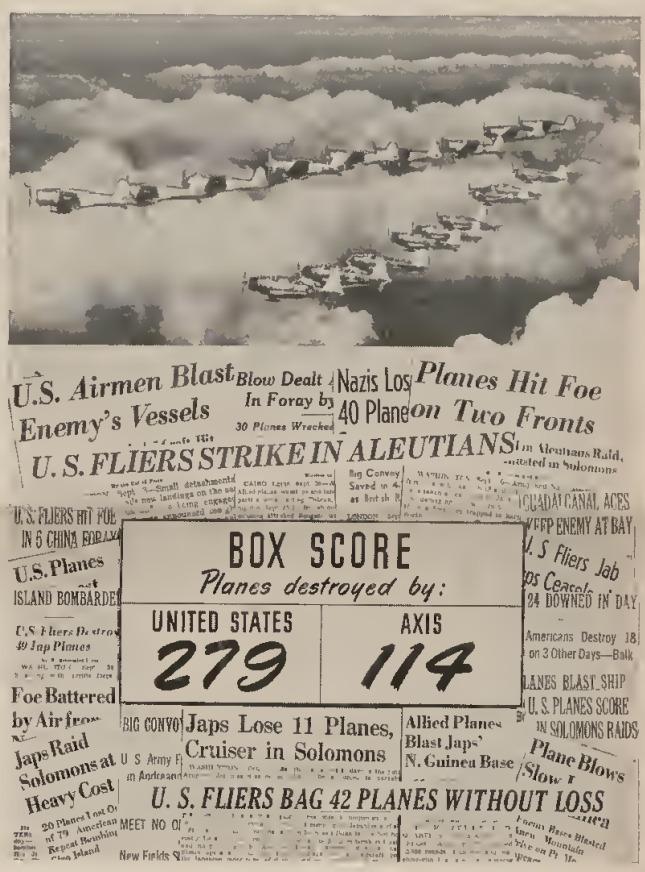
After listening to the testimony of pilots who had used the planes in action, the committee formally reported:

"In the final analysis it is the box score that counts. It is idle to compare the speed, performance and maneuverability of one plane against another when engaged in war. These, in actual combat, are academic questions."

The committee's report then cited the box score from Army Air Force records. Summarized, these figures show that, from Feb. 1 (the date at which accurate breakdown figures by type of plane started) through Sept. 20, United States planes destroyed 279 enemy aircraft in combat on all fronts, with losses of 114 American craft of all types.

"This record," the report concluded, "should be a complete answer as to the fighting qualities of our planes."

In range of equipment, our air forces are unique. No other nation has so many different types of successful fighter craft. No other nation has designed fighters for so many separate and distinct missions. No other nation has fighters for all climates and temperatures.



Though versatility is the chief distinction, there are others. Our air forces are the only ones to install all forms of pilot protection in all fighters. These include leak-proof fuel tanks, the most complete armor plate protection, the heaviest fire power, the longest cruising range and the greatest ability to absorb enemy gun fire and sustain damage without being put out of action.

On the average, our planes carry more ammunition. Our cannon-equipped fighters use shells twice the size of any other fighter anywhere. The .50-caliber machine guns on our fighters have higher muzzle velocities than most enemy planes. They are therefore more accurate, more penetrating, more destructive.

America's fighter planes are the fruit of years of development work by the experienced U. S. aircraft industry. The qualitative superiority of the individual types and the versatility of the full force are fortuitous fulfillments of the demands of total global warfare.

(Continued on Page 4)

FOOD FOR THE MILLS

Motor Plants Intensify Salvage Drives To Keep Steel Output At High Level

Automative plants unearth tons of scrap for steel furnaces.

SUPPOSE Japan possessed 12 times the steel capacity of the United States. It's easy to imagine the tremendous industrial advantage the Nipponese then would have.

Fortunately, the opposite situation prevails. Not only does the U.S. capacity outstrip the Japanese 12 to 1, but America has about half the entire steel production of the world.

Yet if America is to maintain her great steel making superiority, American housewives, farmers and industrialists must turn in scrap for the fiery maws of the blast furnaces.

The automotive industry, always an active scrap supplier, has underway an intensified program to get metals back to the mills.

At its present rate of supplying "food" for the furnaces, the automotive industry is turning over to the mills enough scrap materials to make possible production of 5,104,000 tons of new steel—or about the amount used in making automobiles in one good year.

Thus, in a period when it is still climbing toward ultimate peak production levels, the automotive industry has been cited as being "self supporting."

But because of the seriousness of the scrap shortage, automotive plants have gone far beyond ordinary methods in their scrap drives. Metallic articles, forgotten and out of sight for years, are being unearthed for the steel furnaces.

A 40-pound eagle, whose bronze wings have been covered with dust for three decades, was swept out of hiding in one drive. An obsolete incinerator—steel stack and all—came out of another plant. And another salvage enthusiast, suddenly noticing that his company's parking lot markers were made of old rails, ordered them dug up. Having remained virtually idle for five years, 1,800 tools were pulled down from the shelves of one plant so that considerable additional metal was reclaimed for the mill.

In a ninety-day period, the companies in the automotive industry collected and shipped 297,000 tons of production scrap and more than 40,000 tons of dormant scrap—dies, molds, jigs, fixtures, obsolete machines, and the like. Of the total, over 319,000 tons consisted of iron and steel.

Wood Replaces Metal In Truck Cargo Bodies

Substitute Saves 275,000 Tons of Steel

WOOD, the most abundant of structural materials, is coming to the fore as a pinch-hitter in the war production program. In a score of items it is replacing precious metals needed for guns, tanks, ammunition and planes.

In the automotive industry, wood has already been adopted as a substitute for steel in truck cargo bodies. Witb the exception of those trucks which the Army designates as special equipment carriers, all trucks of 1½-ton size and larger now being produced are equipped with wooden bodies.

Through this substitution, it is estimated, more than 275,000 tons of steel will be diverted annually to other war production needs. This is enough to build 30 large cargo ships. In addition, it brings many small plants such as furniture makers, body builders, and other wood-working firms into war production, utilizing much manufacturing capacity heretofore idle.

At the same time the larger metal-working plants, where the steel bodies were previously made, can now utilize their more versatile equipment on other weapons needed by the armed forces of the United States and its allies.

Approximately 1,000 feet of lumber are used in each cargo body. Manufacturing processes, however, reduce this to 450 feet in the finished body. Species include oak, pecan, sugar maple, hackberry, poplar, beech, pine, fir and hemlock.

The truck job's most difficult manufacturing process is, perhaps, joining the various sub-assemblies where 600 holes must be bored. Some portions of the body sections are laminated with a water-proof glue being employed. Tests show that the glue lines are as strong or stronger than the wood itself. To prevent rot or decay, tbe wood is dipped in a special protective solution and three coats of paint are applied, two being the traditional olive drab.

Fabricated into sub-assembly sections which can be handled and shipped easily, the wooden bodies are delivered to automotive manufacturers for final assembly. Adoption of this method makes possible considerable savings in time, labor and freight-car space.

"EYES" ON THE AXIS

Motor Plants Producing Instruments That Guide Pilots in Darkness, Fogs

Microscopes are used to inspect tiny parts of precision aircraft instruments.

FACILITATING the night bombing of German industrial cities are a series of precise instruments which act as the "eyes" of planes.

No longer forced, as in World War I, to wait until dawn to begin their attacks, AAF and RAF pilots are able to chart their courses through darkness, dense fog or other elements that tend to black out vision.

These "eyes," which demand such precise manufacture that many of the measurements are equivalent to splitting the thickness of a human hair twenty times, are being turned out in quantity by an automotive company, which formerly was a body manufacturing firm.

Called gyro horizon and directional gyro indicators, the instruments guide pilots on a true course and at a constant, designated altitude. Without these two instruments, ferrying of planes to war fronts and long range bombing expeditions would only be possible under the most favorable weather conditions.

Assigned this job only last February, when the firm that developed the instruments was unable to keep up with the rapidly expanding aircraft production, the automotive firm delivered the first instruments to the Army in less than six months. Today deliveries are being made three months ahead of schedule.

Production of such instruments requires precision machining at extremely close tolerances, perfect polishing of tiny moving parts, utmost cleanliness in all mechanism, and adjustments which demand perfect balance. One tiny assembly, for instance, weighs only 15/100,000ths of an ounce, and three thousand of them would fit comfortably into an ordinary thimble.

Even the slightest lint or dust, invisible to the naked eye, will throw off the balance of the instruments. Therefore all manufacture is done in filtered-air rooms, and employes must meet requirements of extreme cleanliness as well as precision manufacture. Special lint-free garments must also be worn by all employes. The plant itself is kept spotless at all times.

More than 700 parts go into the instruments, and after every single manufacturing operation they must be checked for perfect balance. On this task, women have proved exceptionally well adapted.

The chief factor in the gyroscopic operation of the instruments is the minute motor that turns at 12,000 revolutions per minute. Microscopes are used to check the accuracy of the motor's shaft to one-ten-thousandth of an inch. In addition, all bearing surfaces must be as hard and accurate as is humanly possible to make them. They must calibrate perfectly in every operating position.

Some of the operations are so precise that the company has found it necessary to employ numerous watchmakers. Here again every precaution is taken to keep the instruments perfectly clean, glass containers being provided to cover the delicate units.

Before they receive final approval, all the instruments are subjected to the weather elements that are apt to be encountered on flights. First the instruments are placed in an icebox which registers 31 degrees below zero, and secondly, they are removed and placed in 128 degree heat. If any bearing is out-of-balance, a contraction or expansion that will throw the instrument off takes place.

As another test they are placed on a machine which simulates the movements of a plane in flight. This machine imitates the motions as it revolves, and each instrument must perform flawlessly before it is passed.

Before deliveries of any of the instruments are made by the automotive company to the army, each is locked and specially sealed ready for immediate use on a plane.

When the job was taken on by the automotive firm, it was assigned to a plant that was completely bare of equipment. Hospital, plumbing, air conditioning, office and laboratory facilities, as well as production equipment, all had to be installed before work could begin. Unable to obtain much of the equipment needed, the company either made their own or found another way to do the job with the facilities that it was able to procure. Fixtures were built from drawings supplied by the aircraft firm.

A crew of automotive men were welcomed to the instrument manufacturer's plant, where they learned the techniques of the difficult job. Back home, meanwhile, machines and tools were brought into the renovated plant and employes were being hired. Extensive training of supervisors and workers was necessary before production of the instruments could get underway.

REPORT ON FI

(Continued

P-39 The Army's P-39 Airacobra is the world's only single-engine fighter armed with a 37-mm. cannon. In addition, it is armed with heavy and light machine guns. Designed to operate out of small fields, as a destroyer of heavily armored bombers and as an attacker of armored ground forces, it has been in successful combat as high as 30,000 feet. In the month of August Airacobras destroyed 19 enemy planes in combat, with a loss of four. They have achieved a better than four-to-one record against the Japanese Zero, and have won high praise from Soviet pilots who used them against German Messerschmitts.

The unique design of the Airacobra was made possible by an automotive manufacturer's development of its liquid-cooled power plant and its unique power-transfer principle.

P-40 The Army's P-40 Hawk is a versatile performer with an imposing battle record on all fronts. It has written brilliant chapters of history in the hands of the famous "Flying Tigers" in China, in the Far East, the Near East, and on the Russian front. Of this most discussed fighter, a member of the House Military Affairs Committee has said:

"This shark-nosed vessel of wrath has been doubted, adored, damned, praised, ridiculed and lauded more than any other plane we have."

Reason for the confusion is that the Hawk is not one warbird, but several. Since it first took flight in 1937, it has been subjected to many modifications (YP-37, 87A, P-40 and P-40A, B, C, D, E and F). Tomahawk, Mohawk, Kittyhawk and Warhawk are names accorded some of these modifications. As an emergency bomber it has been called "Kittybomber." Russian dispatches have praised "Tomagauks."

Because it has sufficient cooling area to keep it up in extreme heat, the Kittyhawk has proven to be the best of all fighters in desert warfare where Spitfires overheat dangerously.

Like Airacobras, Hawks are powered with liquid-cooled engines. Power plants of earlier types are products of one automotive company. Engines of the same type as used in Spitfires power the P-40 Warhawks, and are being produced by another automotive manufacturer.

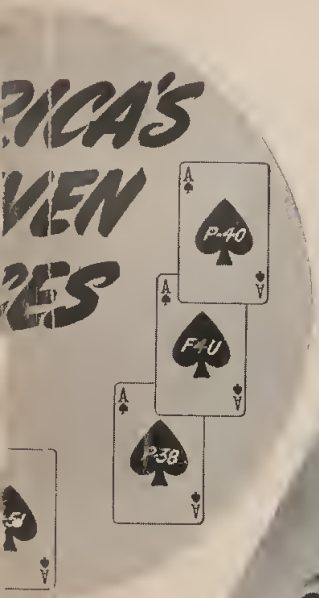
The latest models of the Hawk series are reported to compare favorably with the fifth Spitfire, the eighth Messerschmitt, the last Focke-Wulf and the latest Zero.

P-38 One of the most effective fighters is the Army's P-38 Lightning. Powered by two turbosupercharged, liquid-cooled engines of automotive industry design and manufacture, it is a single-place craft of tremendous speed. Capable of working at extreme altitude, it carries cannon and machine guns, also produced on automotive assembly lines. Lightnings are designed to intercept, attack and pursue, to dive into enemy craft and blast them out of the sky. Hundreds now equip interceptor squadrons guarding U. S. coastal frontiers and vital war production areas. Lightnings are now beginning to be mentioned in battlefront dispatches. The Germans are said to have tried to duplicate this twin-engined, high-altitude fighter without success. Weighing nearly seven tons, the Lightning is built to get "upstairs" fast—about seven miles up, if necessary.

P-47 The Army Air Force's newest threat to the Axis' bid for air supremacy is the huge and powerful P-47 Thunderbolt. No foreign fighter in service has an engine as powerful as its 2,000 h.p., 18-cylinder, air-cooled, turbosupercharged, radial motor, that drives this seven-ton

GHTER PLANES

from Page 1)



devastator. These power plants, the fruit of years of American aviation industry pioneering, are now being produced in quantity by a former motor car manufacturer. Magnesium castings and aluminum forgings are being made in automotive plants also, and contracts have been awarded to still other automotive companies for volume production of important assemblies of the ship.

The Thunderbolt may prove to be one of the most sensational fighters of the war. Though deeply veiled in military secrecy, a few facts about it have become known. These indicate that it has sensational speed and altitude range, plus a fire power that can scarcely be matched. Ordered on Sept. 6, 1940, the first Thunderbolt flew exactly eight months later (May 6, 1941), and subsequent developments in design have taken advantage of every lesson that could be learned from air warfare.

P-51 The Army's P-51 Mustang fighters got their baptism of fire in the hands of the R.A.F. Their speed, maneuverability and firepower made them important factors in the air war before Pearl Harbor. Rated among the best by the British, it has been used with devastating effect in operations over northern France. The Mustang was designed primarily for ground force cooperation. It performed brilliantly in the Dieppe raid. Like most Army fighters, the Mustang derives its motive power and firepower from the automotive industry.

F4F The F4F Wildcat is the Navy's standard fighter. Its short, barrel-like fuselage and stubby wings make it ideal for use from the cramped space of aircraft carrier decks. Powered with a radial, air-cooled engine, it mounts heavy calibre guns in the wings. Wildcats won the first battle honors in the hands of the Marines at Wake. Since then they have been in the thick of every action of the Navy's far-flung operations in the Pacific. Though the little ships were designed as fighters, they have been called upon to serve as bombers and, as such, have sent a Jap cruiser and submarine to the bottom. Their superiority and versatility having been proved in scores of actions, the Navy wants them in quantity and one of the major automotive companies has been tooling its divisions to meet the demand.

F4U In its new F4U Corsair, the Navy has a fighter of great horsepower now in production. The engines of Corsairs are the same as those used in Thunderbolts, and are being manufactured in quantity by an automotive company. Other automotive plants are supplying wings and sections of the airframes. Designed to take off from carrier decks, the Corsair is one of the world's fastest planes. Capable of operating at great speeds up to the highest altitudes, its heavy armament packs a terrific wallop.

For both the Thunderbolt and the Corsair the automotive industry is now expanding productive facilities. The automotive factory assembly-line production of power plants for these fast, high-flying weapons began in one plant in the summer of 1941, just eleven months after ground was broken for the plant. Since then, the engines thus produced have proved themselves, and a second company has been called upon to augment the nation's capacity for producing these superb engines of aviation industry design. To save valuable time, all the fruits of the first subcontracting automotive firm's experience have been offered freely to the second company. Throughout the automotive and aviation industries, formerly competing companies have banded together for the kind of teamwork which modern war demands of fighters.

Do You Know?

This is a war of horsepower. In 1918 the average infantry division was equipped with 3,300 horsepower. Today's armored division musters 400,000 horsepower.

Horsepower on wheels and wings is what the United Nations need most. It is also what the United States can produce best and fastest.

"When Adolf Hitler put his army on wheels," says Lieut. General Brehon B. Somervell, chief of the U. S. Army Services of Supply, "he drove right down our alley."

Industrial experts estimate that the horsepower potential of internal combustion engines produced by one automotive manufacturer alone in 1941 is 100 times the 2,400,000 horsepower generated by the Grand Coulee Dam.

* * *

A new lightweight Diesel marine engine that develops the same horsepower as previous Diesels but takes up only one-third the space has recently been developed and put into operation by an automotive company.

* * *

A new machine has recently been developed for automotive bomber work that performs 10 boring operations simultaneously, cuts a day's work to two hours and saves $1,000 per plane.

* * *

It is axiomatic in the automotive industry that "salvage begins on the drawing board." Automotive engineers like to point out that, although material is saved when scrap is reclaimed from the junk pile, time and labor are the additional savings when better design cuts down the amount of scrap that is made in production. In scores of instances these engineers have applied that kind of conservation to the industry's war production assignments. Dissatisfied with the fact that it takes about three pounds of metal to make one pound of finished gun, they have urged Army and Navy officials to authorize the use of rough billets forged more closely to the dimensions of the finished parts to reduce the time, material, machinery, manpower and transport facilities required to circulate the excess metal through its many processes.

Illustrative of this excess material is the gun forging which starts down the assembly line weighing 55 pounds and leaves the last machine shorn of all but six pounds of its original weight.

Nearing completion, this tank must now be sent miles away for special installations.

Rolling Fortresses Are Prepared for Battle At Tank Depot, Operated by Automotive Firm

ONE of the unique war jobs in the automotive industry, somewhat obscured by the more spectacular activity of actual tank manufacture, is the tank depot now being operated by a former producer of automobile parts and accessories.

Virtually all the medium and heavy tanks being produced in the Middle West are sent to this depot, before the rolling fortresses take their places on the numerous battlefields of this global war.

Here important modifications are made on the tanks, depending upon which of the United Nations' forces they are to serve.

Is this tank for Russia or Britain? The depot must know so the proper radio equipment can be installed. American guns must also be adapted to specifications of our allies. To provide maximum efficiency on specific battle fronts, the depot workers install smoke screen equipment, heaters or air-conditioning units, depending on the destination.

Inasmuch as no advance notice is given to the automotive company on how many tanks it will be called upon to prepare for rush shipment, it may be necessary for its crew of highly-skilled men to work eight, twelve or sixteen hours a day, depending upon the day's load and the time requirements specified by the Army.

Undoubtedly one of the reasons the company and workers were recently awarded the Army-Navy E—the highest tribute made to the home front of America—is the determination of the employes to see a job through to its completion.

On one weekend, for example, when an ocean freighter was being held on the eastern seaboard to take tanks to Russia, this crew of crack mechanics worked continuously for 72 hours with only a few hours' rest in between.

AUTOMOTIVE WAR PRODUCTION

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Automotive Council
for War Production

HARRY A. WILLIAMS, Editor

New Center Building, Detroit, Michigan

Tooling Service Aids War Production Plants

Cartridge Job Speeded By Telephone Call

ONE DAY recently the phone rang in the office of the Tooling Information Service.

At the other end was a worried manufacturer, frantically inquiring about dies for 50 calibre cartridges. His production ran into millions and his dies wore out rapidly. Complicating the job was radius grinding, which called for special tools. Was there a known source for the dies?

"Yes," the manager of the service replied. "I recall that several machines of the type you need were recently taken out of Detroit. Let's see, it was the Ball-something-or-other company in Toledo. I'll check around and see what I can find and then call you back," he told the harassed war producer.

Thumbing through the Toledo telephone book trying to refresh his memory of a company whose name he had once heard, the Tooling Information Service manager located the source —and contacted it. Then he returned the call to the manufacturer and asked:

"How would you like to have your dies made without even giving specifications or instructions to the supplier?"

"Look, fellow, I appreciate your efforts, but I'm in no mood to be kidded," was the short reply.

"Well, that's exactly what I've found," said the manager. "A firm in Toledo is making the identical dies for another arms producer. They have enough open capacity to supply your needs right along with those of the other firm. Get your order in quick."

"Don't worry," came the answer, followed by a sigh of relief.

Contained in the records of the Tooling Information Service are hundreds of similar cases where this branch of the Automotive Council for War Production has aided automotive companies and other war contractors in locating available tooling facilities.

Now, to increase its effectiveness still further, the Service has made an addition to its weekly report that is disseminated widely throughout the industry. In addition to listing open capacity on jigs, fixtures, etc., the report now includes the precision rating and delivery schedules of each company.

More than 200 soldiers can be accommodated on these giant vehicles.

New Truck Trailers Are Designed to Speed Movement of Troops to Danger Zones

TO THE hundreds of essential uses of motor trucks in wartime, add another—the hauling of new giant truck trailers, designed to rush troops to danger zones.

Experiments now being conducted on the West Coast by the Army indicate these 30-foot trailers will be widely adopted as troop transports.

Three platforms, pyramided in the form of steps for quick loading and unloading, provide seating capacity for 206 men.

The transport can be unloaded and men fanned out over a fifty-foot diagonal circle in less than ten seconds. Thus, if enemy aircraft attack the transports and swoop down to strafe the men, not only is a scattered target made, but concentration of fire from more than 200 Garand rifles has an excellent chance of bringing down low-flying planes. The effectiveness of the latter technique has been proved at Dunkirk and more recently in the battle of Stalingrad.

The trailers are hauled by high-powered trucks and the entire unit rolls on fourteen wheels and four axles. The pyramided platforms allow ample space for comfortable travel when the troops are rolling to the front.

An important advantage of the truck trailers is the greatly decreased length of convoys that will be possible. While the widespread use of trucks has enabled the Army to move troops more than 300 miles in one day, even greater distances will be possible with the new transports. Twelve miles was once considered a good day's march.

Deliveries of War Goods Rise 15% in September

DELIVERIES of war products from automotive industry plants continued to rise during September, increasing more than 15 per cent over the previous month.

Preliminary estimates, based on reports to the Automotive Council for War Production from motor vehicle, body and parts companies, show deliveries rose to $512,000,000 during September, as compared with revised figures for August which placed total deliveries of war materials for that month at $445,000,000.

Total deliveries of weapons of war for the first nine months of the year amount to $2,949,337,000. The monthly rate of deliveries in September is equal to an annual rate of $6,140,000,000.

THE LEAPIN' JEEP GOES TO THE WARS AMIDST CHEERS FROM JOHNNY DOUGHBOY

Compact Units Rank High with Soldiers

EVERY TYPICAL American youth's idea of a good time is to get behind the wheel of his own jalopy, pile his buddies around him and, with a heavy foot on the accelerator pedal, roar off on an adventurous jaunt.

It's no wonder then that the soldiers of the United States armed forces have found a new "sweetheart." It's only 40 inches high, yet it goes 65 miles an hour with three men aboard. Light, small and highly maneuverable, it's able to duck behind a patch of grass to escape detection, and is tough enough to slough through swamps and forests, where even tanks can not pass. Or it can be snuggled into a cargo plane and be flown off to another front.

Tbis "sweetheart" of America's youth is, of course, the JEEP.

Like all other military vehicles, the jeep was a development of the automotive industry, in cooperation with Army engineers. It was the outgrowth of a strange looking vehicle, pegged a "belly flopper" by the Army men who were testing it at Fort Benning. Consisting of hardly more than a steel platform on wheels, the "belly flopper" was powered by a four-cylinder engine and was operated by two soldiers lying on their stomachs—one firing a machine gun, the other operating pedals with his feet and steering with a handle in front.

Called to view the tests in the Spring of 1940, automotive executives and engineers chuckled at this "Rube Goldberg" adaptation of a motor vehicle, but were quick to recognize the possibilities of any such small, light device which would be powerful enough to overcome the toughest terrain. While the "belly flopper" never went into production, it started the automotive men thinking, and when several months later the Army proposed a second vehicle which was to be a reconnaissance car, they took the specifications and developed the jeep. Since the first pilot model was approved, thousands of these units have rolled from assembly lines of automotive firms and dispatched to the fighting fronts all over the world.

Going far beyond its original designation as a reconnaissance car, the jeeps have proved so successful that they are being used as all-purpose vehicles.

For instance, it is being used to tow a 37-mm. anti-tank gun into action. Built low, difficult for the enemy to see, it is carrying troops and supplies of food or ammunition to the front. (Flat fenders increase the seating capacity to six.) In addition, a 50 or 30 caliber machine gun, a mortar, or a small anti-aircraft gun can be mounted on the rear seat.

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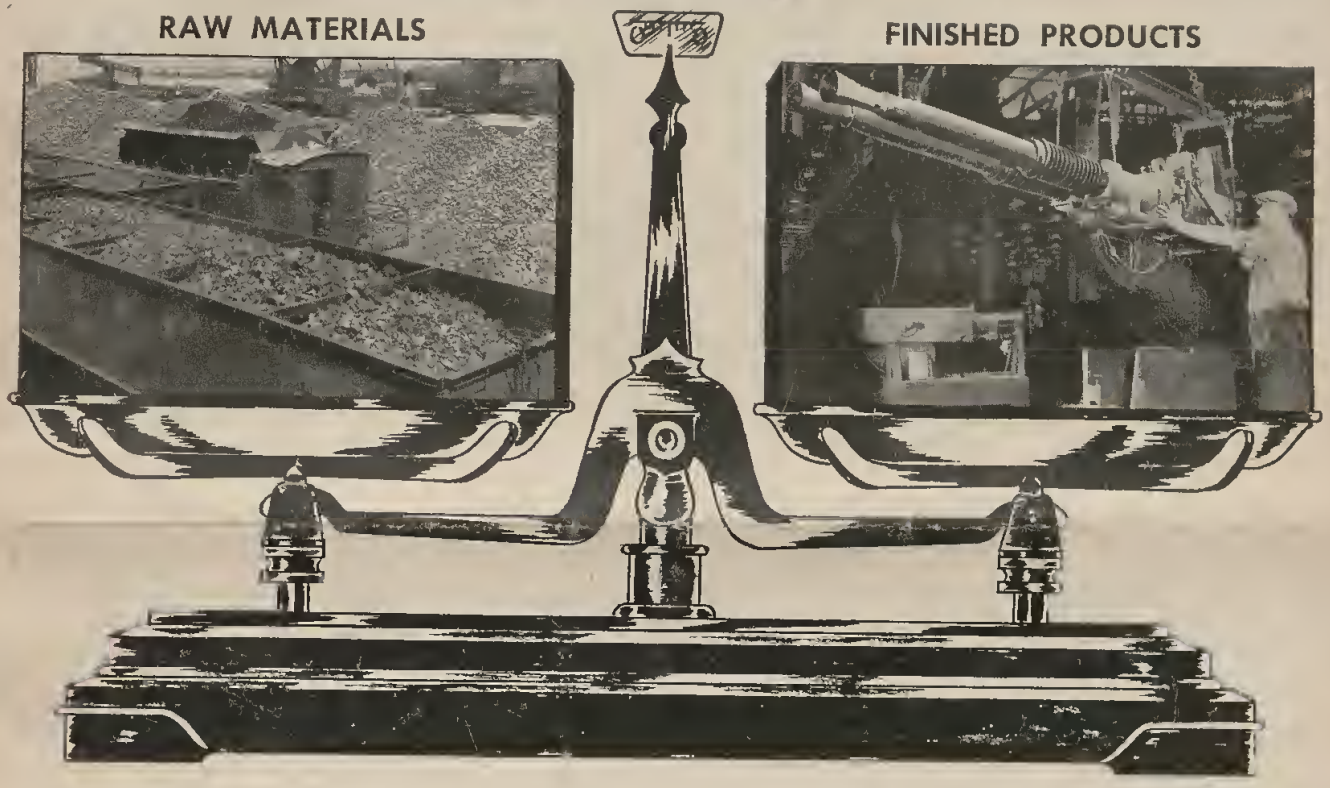


America in New Phase of War Production

Output Schedules of Tanks, Guns, Planes to Be Controlled by Materials Available

AS THE anniversary of Pearl Harbor approaches, the automotive industry, expanded and converted to war work exclusively, continues to push production beyond its highest level in peace-time.

The limits of available raw materials are being approached in the war program generally, and keeping the volume up gets tougher and tougher, yet still larger total production of completed products is to be obtained in the nation through closer scheduling and more efficient distribution of steel, copper, aluminum and other critical metals to the producing industries. This is the objective of the newest material control program of the Government, which proposes to keep all military and civilian production schedules within the quantities of material actually available month by month, but to use these to the hilt.

The specific facts concerning production of weapons coming out of automotive plants remain a closely guarded secret, but some of the indicators issued recently, which will never help the Axis powers figure out exactly what or how much is being turned out, include the following:

Aircraft parts and equipment produced every five days are worth, roughly, the equivalent of a squadron each of heavy bombers, medium bombers and fighters.

The units destined for land armor made each five days, have the same cost as the entire mechanized equipment needed to supply an Army armored division.

Each nine days the output of weapons and their parts corresponds in dollar value to all the guns needed by an armored division.

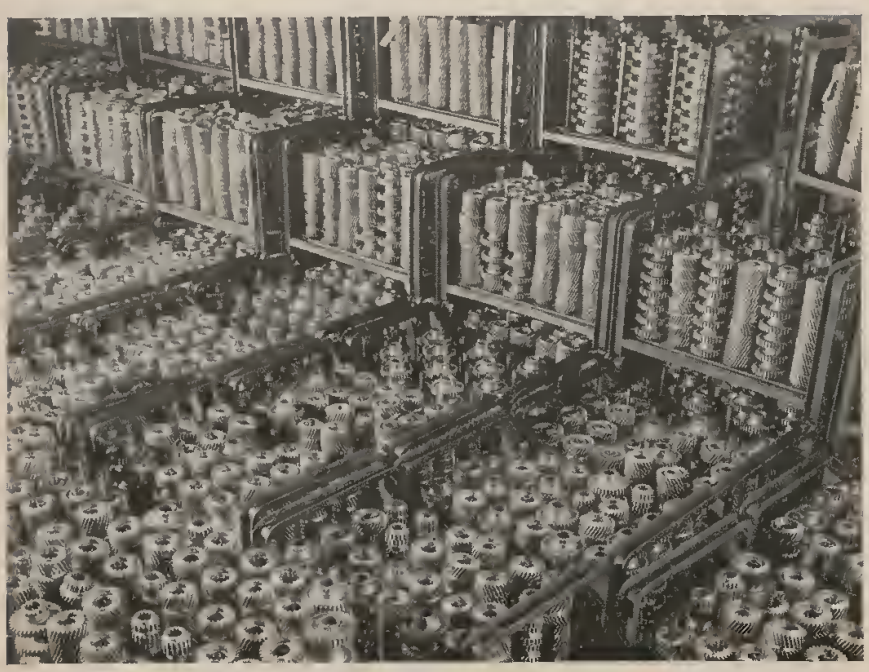
And there is more besides, even from this one industrial aggregation. A stream of armament has been piled up by every method known to the industry for increasing output.

This productive capacity is the direct result of planned expansion, and of orders from the military services in the days following Pearl Harbor which summed up briefly into "Give us all you can make!"

Plant after plant reported its output doubled, redoubled

(Continued on Page 7)

Subcontractors Are Playing Major Role In Output of Automotive War Products



Hundreds of parts for nearly every weapon came from capable suppliers.

"IF A MAN had to eat an elephant, first he'd cut it up into small pieces."

This graphic phrase, used recently by Maj. General Levin H. Campbell, Jr., chief of U. S. Army Ordnance, to describe his department's approach to the handling of its enormous responsibilities in procuring, supplying and servicing the weapons used by our fighting forces, is an exact summary of long-standing automotive practice in producing billions of dollars worth of mechanized goods annually.

Currently made up of more than 700 manufacturers of parts and equipment and fewer than 70 passenger car and truck companies, the automotive industry early learned the value of cutting its "elephant" of mass production into small pieces.

From the start of the industry, more than 40 years ago, the parts suppliers —called "vendors" in peacetime and "subcontractors" now—have been an essential part of passenger car and truck production. They provided highly specialized research and production skills and facilities that few motor vehicle companies could maintain on such a scale. They have been responsible for engineering and producing many improvements in such important automotive subassemblies as axles, brakes, ignition systems, etc.

Just as no motor vehicle manufacturer, no matter how integrated his operations were, could turn out cars and trucks without the help of his suppliers in peacetime, so now no automotive prime contractor can produce war material without subcontractors.

How the industry's well-established practice of subcontracting has grown apace with the war's expanding demand for armaments of all kinds is illustrated by the experience of one passenger car company, which normally produced 77% of the dollar value of its cars and bought 23% from vendors.

This company's most important war contract is for an anti-aircraft cannon —64% of the dollar value of which it buys from subcontractors. Of the gun's 306 separate parts, only 25% are made by the prime contractor.

Nearly all of its 93 subcontractors are companies which customarily make automotive parts. One of these, a producer of service tools, is turning out 29 parts for the gun. It in turn has 30 sub-subcontractors.

Because so many automotive parts companies have their facilities crowded with prime-contracts of their own, the company has had to develop several unusual sources of supply. Among them, a cash-register company—with the help of 20 sub-subcontractors which make stampings and machined parts—is producing the magazine assembly for the gun. The gun-sight assembly is made by an electric iron company; which has 15 sub-subcontractors, while a power shovel company—and 51 sub-subcontractors—shares with a truck company the subcontract for the gun mount assembly.

Thus, the passenger car company responsible for the production of the cannon has cut its "elephant" into 93 "pieces." These 93 subcontractors, in turn have from 10 to 30 sub-subcontractors. Since each of these several hundred sub-subcontractors must buy materials from still other companies, this typical "elephant" ultimately is cut into very small pieces indeed.

New Developments Cut Materials Consumption

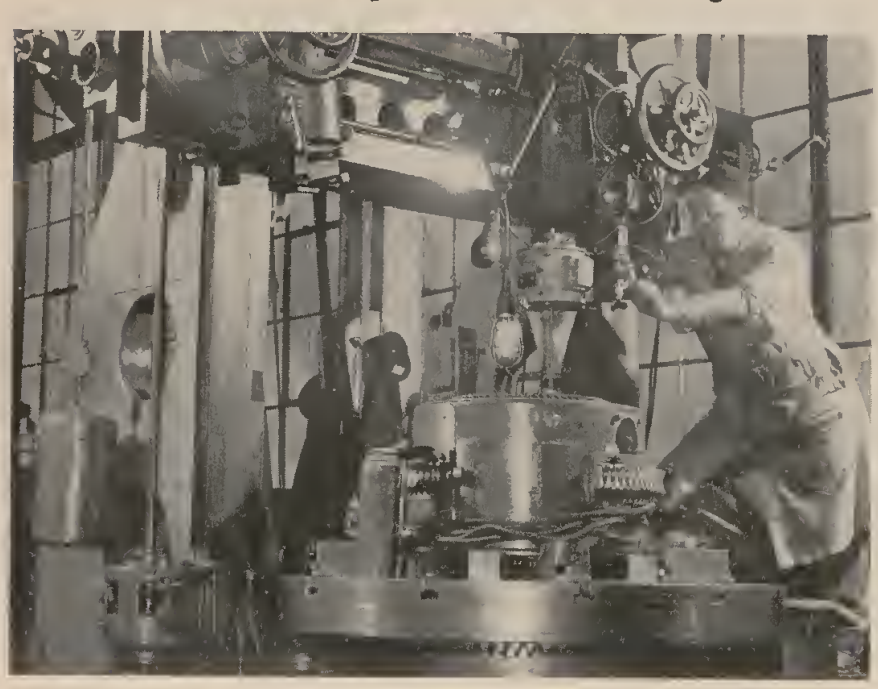
WITH production of war materials by the automotive industry generally at a level today where the only limiting factor is raw materials, the new techniques being developed that substitute more abundant metals for those on the critical list assume added importance.

Engineers and metallurgists of automotive companies are spending long hours, searching out new methods for saving such hard-to-get materials as copper, nickel, tin, aluminum, zinc and chromium. And, they're getting results.

For example, members of the War Engineering Board, which consists of more than 400 of the industry's foremost engineering talent, recently reviewed thousands of parts of the M-4 tank which are being produced by several automotive companies. Specifications for substitute materials which must at least be as good as the materials they replace were submitted to the Army. Receiving approval, the changes are now being made and, based on Army estimates, they will save more than 7,000,000 pounds of nickel, approximately 2,000,000 pounds of chromium and nearly 1,000,000 pounds of molybdenum in 1943 production of M-4 tanks.

Perfecting a method of drawing Army truck headlamp reflectors from steel instead of brass, one automotive firm eliminated 65,000 pounds of copper, 32,000 pounds of zinc, 275 pounds of nickel and 160 pounds of silver in every 100,000 vehicles produced.

Automotive Machine Tools, Once Discarded, Are Rebuilt for Important War Assignments



Boring mill, rescued from scrap pile, is vitol to aircroft engine production.

BY ORDINARY standards, the equipment was obsolete. It was a machine tool known as a vertical boring mill, once used to make rims for automobile wheels.

When the size and type of the wheel changed a few years ago, most firms got rid of their vertical boring mills of this type.

But the value of machine tools is relative. Due to changed circumstances, the equipment which once was deemed suited for the scrap heap is now badly needed.

There are only a few tools left in one automotive city to make the type of circular cut made by vertical boring mills. And the demand is so great for such equipment in war work that the various firms now exchange jobs in order to utilize the existing boring mills to their fullest capacity. For instance:

One automotive company, turning out aircraft engines in quantity, noted that the dynamometer test on its engines was hard on the water-cooled generator. The excessive acceleration and deceleration in connection with the tests developed much heat, causing the core of the generator to expand and freeze, and the water jacket to buckle.

In order to remedy the situation, it was found advisable to mill down a generator part to greater limits. The only equipment which could do the work efficiently was the once obsolete vertical boring mill.

The automotive firm knew of only three places with such equipment and two of them were busy. The third, a large tool shop, did the work. So far, the tool firm has received 15 such jobs.

There have been numerous cases where machines, designed specifically for some automobile manufacturing operation, have virtually been rebuilt in order that they might be used in the automotive war job.

Early in the defense program, for instance, a serious bottleneck in the production of Army 4 x 4 trucks was eliminated by adapting to war production several gear cutting machines which had been lying around "in the grease," unused since the advent of hypoid gears in late model cars.

Army specifications called for a special joint in the front end of the 4 x 4 trucks, which enabled them to be turned without the loss of power in the front wheels.

Such a joint was developed some thirty years ago for front-end power driven racing cars, but was not generally known in the automotive industry. Machines capable of milling the complicated ball-race within the joint were very scarce. The only ones available were the few that the inventor had designed and built years ago and these were being used by an automotive parts supplier.

As orders for 4 x 4s increased, the limited output of joints by the parts firm was not sufficient to meet the demand of the several automotive companies who were building this type of truck. And the supplier was convinced that no other machine could do the job. It appeared likely that truck production would suffer for several months, while new machines were being built.

An ingenious gear cutting specialist of an automotive company, however, thought of the old machines that had been lying around idle. Experimenting with ways to adapt them to the job, he designed a special cam arrangement which generated the machines in such a way as to cut the four separate faces of the ball-race to specifications.

Within ten days this plant's machines had been converted to the new job and mass production was under way in 45 days. Six of the machines have since been turned over to the parts company and two other automotive companies were given details on how the conversion was accomplished.

Still another automotive company recently rescued an old punch press from the scrap pile and, adapting it to its gun job, effected an important short-cut in production time.

Formerly obdurator rings were inserted into the breech end of the gun barrel by hand. By retooling the old punch press and through the use of a special fixture the rings, whose insertion formerly required about 15 minutes each, are now squeezed into place in less than a minute each.

Obsolete machines cut complex joint.

WOMEN WORK FOR VICTORY

Thousands Trained by Automotive Companies to Replace Men on Machines, Assembly Lines

Women learn drafting in automotive plant building aircraft engines

AMERICAN women, no less today than in the days of the Pilgrims, work and fight side by side with their men

The same spirit and determination that made the westward migrations of the last century an epic of feminine heroism is being evidenced currently as more and more wives, mothers daughters and sweethearts take the places of men in the armed services and in industry

As the nation goes all-out in mobilizing its manpower for global warfare, nearly 3,000 000 girls and women are doing the work of men at the drill presses, the rivet guns and the giant machines that are today's industrial equivalent of the Pilgrims muskets and the Forty-niners' long rifles and sharp plows

There is nothing new about women in industry, of course—except that in today's movement they are taking over jobs that traditionally were considered man's work During the last war more than 2,000,000 of 9,000 000 workers were women Since that time, women have worked shoulder to shoulder with man in many industries. This has been particularly true in the automotive industry.

Now that the automotive industry is making armaments instead of new cars and trucks and must replace the thousands of male employes who have entered the armed forces, women are being trained in skills that previously were considered exclusively in man's domain

They are learning and practicing the operation of automatic screw machines, drill presses, welders, calibraters, gages and micrometers They are serving as technicians in checking and testing raw materials

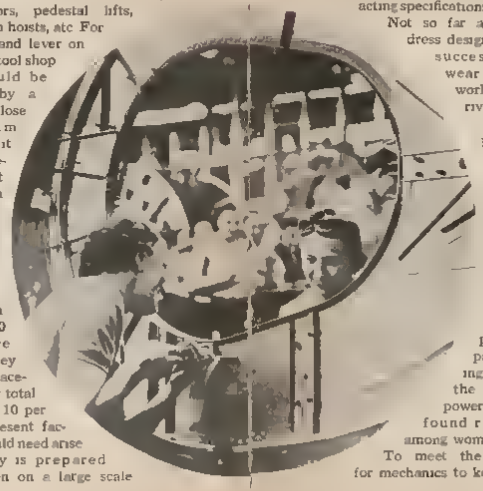
After brief periods of schooling, women are moving in wholesale lots into final assembly work requiring the use of hand tools, and into the wiring and assembling of small parts, such as electrical equipment, and into the spray painting booths

With slightly more training—the same amount that new men receive—they are proving adept at operating complex types of milling machines, presses and lathes Their deft fingers are showing themselves particularly adaptable to burring polishing and lapping and buffing on lathes at hand-hanishing machined parts, at spot welding soldering, spray painting packaging, labeling and inspecting

Women could scarcely be expected to fill the growing need for highly skilled specialists, yet there is at least one instance in the automotive industry where this is so Nearly a dozen young women are doing tracing work and re drawing in the drafting room of a plant producing high powered aircraft engines Within a short time their employer forecasts, they will become skilled draftswomen

One of the younger girls learned the art from her father, who has worked for the company in an adjacent drafting room for 21 years

To overcome physical limitations in departments employing women, automotive plants have installed considerably more than the normal number of mechanical aids such as load lifters, roller conveyors, pedestal lifts, automatic chain hoists, etc For instance, the hand lever on a machine in a tool shop formerly could be moved only by a man exerting close to maximum strength Now it has been so redesigned that a woman can operate it with her fingertips



Employment rolls of one automotive company already contain more than 50 per cent more women than they did during peacetimes, and they total approximataly 10 per cent of the present factory force Should need arise this company is prepared to train women on a large scale

Several new machine tool plants are now nearing completion in the Detroit area Company officials declare that more than 75 per cent of the workers will be women when the plant reaches peak production levels

Another automotive company is now employing more than 9 000 women on important war production jobs Work ranges from the operation of giant cranes that transfer heavy parts around the plant to the handling of delicate gear parts for a high precision aircraft motor

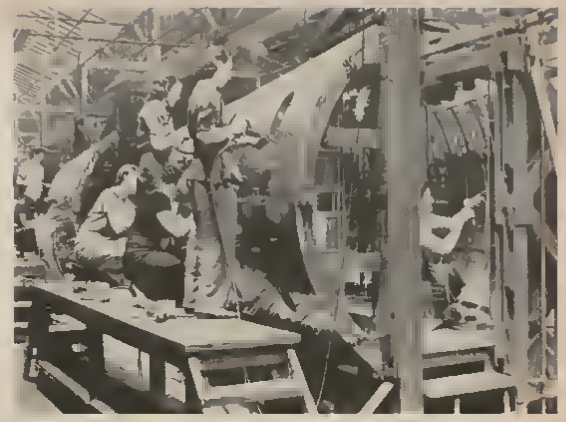
To become an inspector of aircraft parts, one university graduate has sacrificed or deferred a stage career After several years in road shows, she finally got her big chance—the offer of a part on Broadway Before the play opened, however, the Japs hit Pearl Harbor The actress decided immediately that her place was on the production front and not under the spotlights, at least for the duration She's working nights, making sure that materials meet the exacting specifications of the Air Corps

Not so far away, an expert dress designer—owner of a successful women's wear shop—also is working nights, as a rivet inspector

One automotive plant now producing tanks recently lost a machine operator to the armed forces The drafted employe's machine is now being operated by his wife.

Even plant protection departments, feeling the pinch of the growing manpower shortage have found replacements among women employes.

To meet the growing need for mechanics to keep the nation's transportation facilities in operation several automotive companies have opened mechanic's training schools for women Of 700 service operations on one medium sized car, a study shows that women can perform around 500 They can serve as helpers in an additional 110 operations. Only a very few service jobs can be done only by men



An automotive plant has found the fairer sex well suited for riveting.

Many women previously engaged in motor vehicle production have been transferred directly to war work Their ability provan, they were preferred, in many instances, to untrained men

A mother and daughter team, for instance, has been working regularly for many years at one automotive company For 23 years, the mother worked in the parts shipping department Recently she was transferred to similar work in the new aircraft division The daughter has been on the payroll 14 years, beginning as an office elevator operator and now heading the company's post office department.

Three sisters, plying their nimble fingers in the trim department of this company before the war, are now busily engaged in aircraft production Two are inspectors of parts, while the other is a clerk

At the same plant a mother of six children has been working for the past 13 years She is making small parts on a lathe for aircraft engines

At another automotive plant, where delicate aircraft instruments are being turned out, more than 50 per cent of the employes are expected to be women workers In each step of manufacture the instruments must be checked for balance and women have proved particularly adapted to this close work

The manufacturing manager of this plant recently declared that "nowhere are women doing a more important job in the entire armament program than on this job"

In virtually every plant in the automotive industry, uniform work garments—dresses or the increasingly popular slacks—are being worn by women Not only does such uniformity reduce safety hazards in the factories, but, say plant managers, it also is a contributing factor to high morale

Long Idle Automotive Wood-Working Plants Busy Building Gliders and Bomber Sections

IDLE FACILITIES are being transformed into vital facilities as war uses are being found for the long moribund wood-working plants in the automotive industry.

Once processing a half billion square feet of lumber annually in the manufacture of motor vehicle bodies, multi-million dollar wood-working plants became useless as all-steel bodies came to the fore—until the nation suddenly needed bombers and gliders.

Rated among the finest in the world, the automotive wood-working factories employed thousands of workers to operate the expensive equipment required to process lumber into structural parts for passenger car and truck bodies and tops. Then the all-steel body was introduced. Soon the body top too was made of steel, displacing fabrics supported by wood and steel.

Consequently the wood-working plants, representing millions of dollars of invested capital, were relegated to minor production roles. They were stripped of much of their equipment; other industries purchased machines that were useful in their work. Employes, too, were moved out. Many were shifted to other phases of automobile manufacture.

Now, however, under the exigencies of all-out war, these old plants have been taken "off the shelf."

One of the largest, for example, is now producing sections for one of America's hard-hitting two-motored bombers.

The only activity of the plant, when it was called into the aircraft program nearly a year before Pearl Harbor, was the manufacture of such small body accessories as arm rests. The remaining equipment could not be used in the new aircraft job, so it was moved out.

Hundreds of new machines were then brought in and the plant was expanded to over fourteen acres of floor space—double its previous size. Close to 2,000 jigs and fixtures, some measuring as much as 20 feet long and 10 feet high, also were built before the work got under way.

Outmoded and virtually useless in peacetime, the plant today is operating at greater capacity and with far more employes at work than ever before.

In another old automotive wood-working plant, used in late years for constructing station wagons, a new project—production of giant transport gliders—has recently been undertaken. The first model of the glider, virtually hand-made by the automotive firm, has already been successfully test flown and given approval by the Army.

Differing from the job of the other wood-working plant of the industry, this undertaking calls for the use of a considerable amount of wood. Thus the same skills and machinery are required that previously were used.

The fuselage of the engineless airplane is built around a framework of tubular steel, covered by a long-fiber cotton fabric. Wings are constructed of aircraft spruce and mahogany plywood.

Already many of the glider parts are being produced in quantity at the old plant. Wood craftsmen, idle since the outbreak of war stopped production of station wagons, are back at familiar machines, plying their trade with characteristic precision.

New Device Improves Production of Shells

WHEN SCRAP is reclaimed from the junk pile, material is saved; but when material is kept off the scrap pile by intelligent planning of production, the savings are fourfold—material, time, labor and money.

Salvage of this latter variety is the aim of an ingenious device perfected by tool engineers of a company whicb formerly manufactured motor cars but is now producing war material.

This device is an "ounce of prevention" gauge which, employed in the production line of this company's shell manufacturing department, has virtually eliminated government rejection of finished shells.

The gauge is a three-pronged instrument which fits into the cavity of 155 mm. shell forgings and pre-determines through mathematics the weight of the finished shell. Applied to the forgings on the moving conveyor which carries them from the rough-turning to the finishing machines, it enables workers farther along the line to nose the projectiles so that the finished product will comply with rigid Army specifications, which allow one pound over or under the prescribed weight.

Since the gauge has reduced rejections from about 10 per cent to less than one per cent, and since it has been used in the production of more than a million shells, the resultant savings are already considerable, whether measured in material, time, labor, or money.

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Army's Mobile Maintenance Units Equipped to Keep Virtually All Weapons in Service

BATTLE dispatches from fronts all over the world indicate that American troops are enthusiastic about the quality of weapons that industry is pouring from assembly lines.

Knowing that victory, to a great extent, depends on maintaining this confidence, the United States Army has established rolling repair shops which follow close behind the firing lines, ready and equipped to repair all types of weapons. Of the many types of military vehicles which 29 automotive companies are producing for the armed forces, probably none is more important than the units that go into these battalions.

Each maintenance battalion consists of 30 vehicles, ranging from motorcycles to huge 36,000 pound trucks.

Equipped with vast supplies of tools and replacement parts, the battalion is capable of repairing more than 90 per cent of an armored division's small arms and mechanized equipment.

Equal in equipment to first-class garages is the unit that is devoted to automotive repair. Included among its equipment is a portable gasoline generator, which can be carried anywhere for battery charging. If a minor breakdown has put a vehicle out of action, a small repair kit can be rushed by motorcycle to the scene.

Compact while in motion, these mobile repair shops are quickly readied for work in the field by the operation of a hydraulic pump which opens the sides and elevates the roof.

Hundreds of replacement parts are carried in steel drawers under the work benches. To keep the spare parts in place while the vehicle is in motion over rough terrain, the drawers are clamped into position with locking bars.

In addition to the automotive repair unit, each battalion's equipment includes a machine shop, complete with power-driven machine tools; a wrecking truck, equipped with crane for pulling tanks or trucks out of ditches or mud; a small arms truck, containing tools and parts for reconditioning rifles, pistols and other small bore weapons; and a mobile welding shop, supplied with armor plate and welding equipment for patching damaged armor in tanks or trucks.

Available Materials To Control Output

(Continued from Page 1)

and increased again until in many lines Army and Navy found a production capacity created that outran their strongest expectations. Even so, in some items it was the demand that outran expectations so that on a selective and careful basis expansion of producing capacity continues.

With so much of the expansion accomplished, however, war strategy is calling now for balanced output—so that every ton of raw material available may be processed into the specific types and quantities of armament needed most, and may go to the battlefronts without delay.

This involves making sure that material isn't sidetracked into any items that will have to wait a long time for companion units—whether these be airplanes and their engines, tanks and their guns, ammunition and the weapons to hurl it at the enemy.

More than that, with the total supply of critical materials inadequate for manufacturing everything that could be turned out, the program requires cutting back all secondary items to the minimum in order to make way for the products most vital at any particular time, whether these be bombers or cargo ships, or something else. Army and Navy, as well as civilians, are doing without things they want so as to get those that are indispensable.

Flexibility dictated by strategy and the course of the war, also may involve major changes from time to time, greatly stepping up one product needed for a specific job, and temporarily cutting down to a mere trickle the output of assembly lines set up for another.

With output of goods for civilian use now cut to the bone, and soon incapable of releasing more material, further sources of net increase in war production will be: the relatively small expansion in supply of raw materials still to be accomplished (and this includes all the scrap that can be obtained); more ingenious ways of saving strategic metals in each war product (a research process that is going on unceasingly throughout industry); and close control of the flow of materials and accumulation of inventories (the latter including not only raw materials waiting to be used but also war products waiting for a part to come from somewhere else).

AMERICA'S HEAVY BOMBERS MEET BATTLE TEST

Giant Ships Are Products Of Cooperative Craftsmen

HEARTENING news to workers in more than a dozen automotive factories are the reports now beginning to come from the figbting fronts on the battle performance of U. S. heavy bombers.

Out of these reports there is emerging validation of the American conception of the four-motored bomber as a dominant warplane of the future.

In late 1940, when the heavy bomber still was called a "flying target" by many critics, the automotive industry was called upon to help the already heavily burdened aircraft industry in meeting the nation's first mass production schedule for these huge craft.

By the end of 1941, parts from the automotive industry's learning workers were beginning to flow into aviation industry's assembly plants. By the end of 1942, thousands of newly skilled automotive workers are producing bits and pieces for heavy bombers—fuselage sections, landing gear forgings, armaments, power plants, etc. Production schedules are being met, or passed.

Early critics who believe America's Flying Fortresses and Liberators were inferior to such British four-motored craft as Lancaster, Stirlings, Halifaxes and Manchesters failed to consider that the British planes were designed for the defense of Britain and the American planes were designed for the defense of America.

Built to cover the relatively short distances between bases in England and targets in Germany and occupied territories, the R.A.F.'s big bombers are carriers of enormous bomb loads. Lightly armed, they depend upon fighters for protection. Flying only at moderate altitudes, they are most effective at night.

America's heavy bombers, on the other hand, are designed for daylight attack at high altitudes, with high speed, long-range and powerful armament to eliminate the need for fighter protection. This means commensurate sacrifice of bomb-load capacity.

Effective answers to the critics of the Army Air Corps' big warplanes have been coming to America in a swelling stream of battlefield reports in recent weeks.

One of the most welcome of these reports to hit the bulletin boards in automotive plants was one which told of the shock which *Luftwaffe* pilots got when they rose to attack a daylight flight of Flying Fortresses in their fastest and most heavily armed Messerschmitts and Focke-Wulf 190s.

Accustomed to sitting beyond range of .30-calibre guns and knocking down British bombers with light cannon, Goering's fighters were caught in deadly, long-range, high-velocity cross-fire laid down by the Flying Fortresses, each armed with from ten to 13 .50-calibre machine guns in nose, tail, top and belly turrets.

In one encounter with the daylight-raiding fortresses, the Germans lost 48 fighters in a few moments but the big bombers held their formation, executed their mission and returned to their bases.

Since then additional reports have cheered the automotive workers who are producing parts for the big bombers.

And, although details are censorable, the workers know that changes and adjustments have been made to fit some of the U. S. aerial battleships for short hops with huge bomb-loads.

As in the field of fighter plane design, the preparations of the military and industrial leaders in U. S. aviation seem to have been planned to meet exactly those demands for versatility with which global war unpredictably confronted American air forces.

Coming up from the drafting boards and assembly lines of the U. S. are further surprises for the Axis. The present Flying Fortresses and Liberators are merely forerunners of the heavy-gunned planes to come.

These "big fellows" are uniquely American. Commentators point out that they are the fruit of that kind of voluntary cooperation which carved America out of the wilderness, wrought it into a great nation, and leaped to its defense whenever its status as the hope of free men was endangered. Every Flying Fortress and Liberator that roars into the blue is the product of the teamwork of free minds. Collaboration, such as has been achieved between the U. S. aviation and automotive industries, is an instrument which does not work in hands that bear the scars of shackles. It is America's secret weapon. The more its power is tapped, the greater its strength becomes.

AUTOMOTIVE WAR PRODUCTION

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Year's War Effort Is Record of Achievement

Automotive Plants Overcome Many Problems To Reach Highest Production Peak in History

TRANSFORMED into the world's mightiest arsenal, the automotive industry enters 1943 on a level which is a new height of achievement. Behind it lies twelve months in which, despite multitudinous and complex problems of conversion, its total production bulked larger than in any previous year in its history.

As passenger car and civilian truck output halted completely in 1942, the production record was the more remarkable for having been made, to great extent, from a standing start.

Moreover, since many of the weapons now being made in quantity were of such recent design that no techniques for their production had been developed, the transition from pilot plant to quantity manufacture, normally a long process, was often telescoped into a brief span of a few weeks.

In addition, the industry struggled throughout most of 1942 with material shortages, tooling delays, loss of personnel to the armed forces, and a host of other problems which were deterrents to orderly production in 1942.

Yet, the momentum of the work mounted steadily from the low level of spring until, at year's end, the industry was producing planes, guns, tanks, etc. at the rate of $20,000,000 daily.

Total production for 1942, contrasted with the previous record year (1941) was:

	1941	1942
Arms	$ 870,000,000	$4,665,000,000
Civilian goods	4,068,000,000	821,000,000
Totals	$4,938,000,000	$5,486,000,000

At the end of this year of record achievement under difficulties without precedent, automotive industry leaders predicted a doubling of volume in 1943. Such an output of war materials, now believed possible, would be equal to production of 20,000,000 passenger cars and commercial trucks. Highest peacetime output was 5,358,000 units.

Human effort is a better yardstick than dollar volume in

(Continued on Page 4)

MOTOR INDUSTRY SPANS U. S.

Automotive Plants, Located in 31 States, Rely Heavily on Talents of Sub-Contractors

"Detroit" is a symbol for an industry that spreads from coast to coast.

MANY PEOPLE who say "Detroit" when they mean "the automotive industry," catch the spirit of the industry well enough, but they certainly miss a lot of its substance.

The nation's fourth largest city does contain the world's greatest concentration of automotive production capacity, but the automotive industry as a whole consists of nearly a thousand plants, large and small, scattered through 31 of the 48 United States.

Of the industry's approximately 960,000 war production workers, more than half are employed away from Detroit and its immediately adjacent cities. In peacetime, ten of a total of 17 makes of passenger cars were produced outside of Detroit proper and only three of 50 makes of trucks and buses were assembled within the city limits. Including such contiguous cities as Hamtramck, Dearborn, and Highland Park, the Detroit area normally manufactured 10 lines of passenger cars and four lines of trucks.

Distribution of the automotive industry's war work is even more widely decentralized, in regard to the industry's symbolic center, than was the fabrication of its peacetime products. This is due to two main factors:

1. Tremendous size of the armaments orders awarded to motor vehicle companies following Pearl Harbor necessitated a major expansion of the industry's already well-developed subcontracting system in order to make full use of existing specialized production skills and facilities of the parts and motor equipment manufacturers, whose plants are dispersed throughout the country.

2. There was universal knowledge on the part of management, from the start of the war, that the Detroit area would be unable to handle as large a proportion of the industry's war work as it did of peacetime work, due to the relative inelasticity of the number of workers available in the area. Thus many of the new plants built by automotive companies were established in communities where surveys indicated large numbers of new workers would be available.

Production of aircraft engines, for instance, generally requires completely new plants, for few of the buildings used in automotive manufacture are efficient for this vastly different type of work.

Of the new plants erected by the industry to fabricate power plants for the nation's bombers, fighters and transport planes, only two are located in the Detroit area. Three of the largest plants are in Indiana; three others, including the world's largest, are in the Chicago area, while New York and Wisconsin each have one of the industry's aircraft engine plants.

The nine automotive manufacturers of aircraft engines are operating or constructing a total of 13 new production and assembly plants. They are located in eight cities and five states. These plants, which are responsible for about 25 per cent of the industry's total war work, obtain a large share of the required parts from hundreds of other widely scattered plants of the industry.

This example of the wide dispersal of aircraft engine work, made possible and made efficient by long-standing peacetime practice, is typical also of the industry's handling of its production of planes, tanks, guns, shells, armored vehicles, military trucks and other vital armaments. No plant, no matter how modern nor how well integrated, can fabricate a mechanized weapon of any kind in volume without the assistance of many others in the industry.

Of the 986 automotive plants working on war products, following conversion from passenger cars, commercial vehicles and parts, 201 are owned by motor vehicle companies and 785 by parts and equipment manufacturers. Although 792 plants are concentrated in the Great Lakes states, the industry's factories range from coast to coast and from border to border. There are 41 automotive plants in the three West Coast states and 93 along the Eastern seaboard.

There are more than 20 plants in the Southern states and 80 west of the Mississippi River. In fact, only 17 states in the entire country are without one or more automotive factories, and even these states, with few exceptions, are important sources of the raw materials used alike in producing the peacetime and wartime goods of the automotive industry.

Truly, "Detroit" is a mere symbol of a nationwide industry.

THEY SET THE PACE

Management Instills the "Chins Up" Spirit When Going Gets Tough on War Assignments

Lang haurs are spent in planning mass praduction af war materials.

KEEPING MORALE high on the production team frequently requires a quality of leadership such as a Knute Rockne or a Bernie Bierman supplied to their champion football squads.

Maintaining morale takes more than plastering the plant with posters, for production schedules often are influenced by factors beyond the control of management or men.

A decision made thousands of miles away, resulting from an unpredictable shift in war strategy, may upset the best-laid plans of automotive organizations.

On such occasions, the work of many months gets tossed on the scrap heap. The results of long hours spent over drafting boards, around conference tables, in shops and tool rooms are cleaned off the slate.

Understandably, such news can be demoralizing to men who have set their sights on a particular goal, as demoralizing as it would be to a Latin scholar if suddenly told his final examinations were to be in Greek.

When drastic production changes come it is a function of management to rekindle spirits, infuse new energy into the organization, and keep the men marching toward the new objectives. Some recent cases:

One automotive company, working day and night to get into production on a new fighting plane, got a shock when the Navy requested the removal of two of six items in one of the major components of the ship. Some 4,000 production operations would be affected by the change. And 50 per cent of the tools and jigs required for the manufacture of the major component would have to be scrapped or reworked.

The notice came before the company had completed its first planes; the orders specified that the change was to become effective with the tenth ship.

It is not on record whether the men who had spent months in tooling up for this job felt pangs of chagrin when only 10 parts were run off. The books do show, however, that the organization picked up the specified change, corrected its tools, and never lost even a day on its promised production schedule.

Another company, starting out to build an experimental type of tank, received a seemingly endless number of design changes. Time and again the organization made alterations in the production facilities. After struggling with several thousand changes, some involving several months' time to make, the company was finally ready to produce its first model.

With the entire tank organization keyed to a high pitch in the expectancy of seeing the first finished product roll out, a last-minute change came through which called for retooling of one of the major components. Informed of the news, the technical staff buckled down to months of additional preparatory work.

Having poured five months' time and energy into one type of aircraft engine, an automotive company was suddenly asked to stop all work. A high Air Corps official had just returned from the fighting fronts, convinced that production of long-range heavy bombers should be stepped up sharply. That precipitated a great need for a different type of aircraft engine.

"Will you shift over to this new engine?" the Air Corps asked the automotive firm.

Scrapping nearly a half year of work, including virtually all of its hard-to-get tools, the automotive organization undertook the new assignment. Instead of letting their morale sag, the managerial men put all their energy into the new task and infused so much enthusiasm into the organization that engine production under the new schedule was advanced four months.

One automotive organization manufacturing fighting planes has had to retool many of its operations twice and some of them three times.

"This condition will not abate," the company's general manager recently stated. "It will continue just so long as the experiences of our airmen dictate the needs for changes."

The reshuffling of war contracts in the period ahead because of changing military needs will test morale time and again, putting additional demands on managerial leadership.

It will again make clear that one of the important functions of management is the power of example. By willingness to shoulder new problems and responsibilities, management sets the pace for the organization as a whole.

Above, completed aircraft engines at one of nine automotive plants engaged in manufacture of liquid or air cooled types. At year end, automotive companies were producing aircraft items at an annual rate of $2,250,000,000. Below "General Sherman" tanks roll off automotive assembly lines, part of the $2,000,000,000 output of tanks, combat cars and military vehicles delivered in the past year.

1942: Year of Achievement in Motor Industry

(Continued from Page 1)

measuring the achievement. According to employment figures, there were 960,000 workers on the payrolls of 775 principal automotive plants at 1942's end. This was a 26 per cent increase over the record peacetime high of 761,000 in 1941.

Mere statistics however, cannot portray the effort adequately for they miss entirely the most important facts. They say nothing of the work which men did in clearing decks for the flood of unfamiliar tasks heaped upon them early in 1942. Figures hold no hint of the tremendous contributions made by men who worked far into the night seven days a week, every week, planning and putting together the intricate networks of mechanical processes required for the mass production of weapons. No statistics can reveal the cumulative work whereby such men refined their ability to conceive plans that work exactly as planned.

Too, figures only obscure the untold stories of the workers who prepared the way for new work as conveyor lines were ripped out, machines uprooted and moved, either into some newly planned integration or into storage yards to await assignment to war work or consignment to scrap.

Nor can any statistics show how richly the years of peacetime research paid off in benefits to the nation in 1942.

For as war disrupted lines of supply of those very materials which war demanded in increasing quantities, the shortages that threatened to impede production of arms were averted time after time by the use of substitute materials or alternate methods that had been developed in the laboratories of the industry. Adopted after meeting the high standards of military tests, such substitutions were often the fruit of those competitive efforts with which ingenious American minds strove constantly to make better things in greater quantities at lower costs for more people.

Such was the origin of one automotive company's substitution of sheet steel stampings for aluminum castings used in anti-aircraft searchlights—an application of ingenuity and enterprise which effected a saving of more than 100,000 lbs. of aluminum each month.

Figures cannot portray the background of experience in sound planning, inventive genius and manual skill which the trained minds and hands of the automotive industry brought to fore in 1942. Not until victory makes it once more possible to reveal facts and figures in a peaceful world will it be safe to discuss the number and nature of production short-cuts and the huge economies which were thus effected on hundreds of contracts.

One example which can be cited is that of an automatic gun contract. On its original contract, one automotive company was able to lop $250 from the price of each gun. Then, after further refinements of processes, this company cut costs another 40 per cent.

It has been estimated that, on orders allotted to the industry to date, such applications of techniques mastered in years of peacetime competition will save taxpayers approximately three billion dollars.

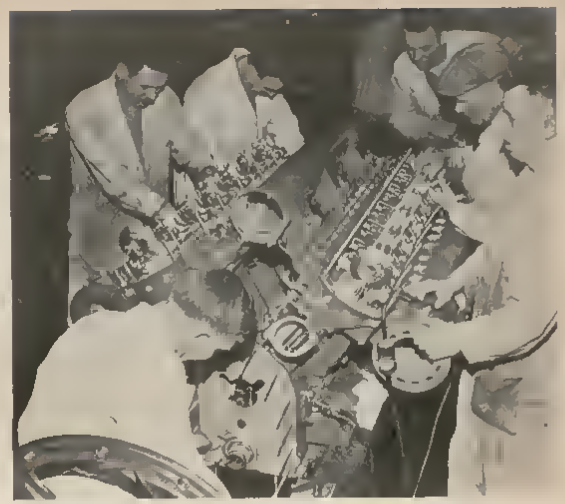
Again figures say nothing of savings of time, that most precious of 1942's values.

When production of weapons was held up for lack of specially-designed machine tools, automotive master mechanics made countless amazing adaptations of existing equipment. In some cases such conversions eliminated entirely the needs for new tools. In others they were fortunate stop-gaps.

Usually overlooked in discussions of conversion is the fact that it is not confined to machines, methods and materials. For the most essential aspect of conversion—the conversion of man—the industry's school systems, maintained in peacetime, were readily adaptable to meet the exigencies of war. Through these educational facilities, expanded and augmented, thousands of workers were passed in 1942.

In addition these facilities were themselves converted in many cases. To keep planes, tanks, trucks and guns working at peak efficiency on the fighting fronts many firms adapted their schools for the training of men of the armed forces in proper maintenance procedures. Today the industry is second only to the schools at the Army's proving ground at Aberdeen, Md., in the number of Ordnance maintenance men being trained.

About such dramatic achievements statistics say less than nothing.



During 1942, the automotive industry delivered $250,000,000 worth of marine equipment—torpedo boat engines, landing boats, cargo vessels and other naval equipment. Below, anti-aircraft guns that hurl their explosive projectiles seven miles into the sky are part of the $500,000,000 in guns and ammunition that rolled from automotive assembly lines last year.

Clothing Styled for Women War Workers

Uniforms Serviceable As Well as Attractive

THOUGH SAFE and serviceable, shop uniforms for working women need not be unattractive. This fact is being demonstrated daily in a number of automotive plants in which standard uniforms have been adopted for women workers.

An example of styling shop clothing for safety without sacrifice of attractiveness is illustrated herewith. The young lady shown above is a machine operator in a factory devoted to the manufacture of aircraft cannon. A year ago this plant was a warehouse for the storage of repair and replacement parts for automotive farm machinery Situated in a midwestern community containing relatively few trained mechanical workers, the plant was staffed with a score of supervisory workers who set up the necessary machinery and trained workers drawn from the neighborhood.

To get into production according to schedule it was necessary to hire and train many women. To guard these untrained women against unfamiliar shop hazards, the management devised the uniform portrayed here. The cap is equipped with hard and smooth top and visor to guard the wearer against the danger of getting hair entangled in machinery.

In this plant, where the proportion of women workers is now almost 50 per cent, the management reports that the uniforming of women seems to have had beneficial effect on the safety record.

Industry's Ability to Step Up War Output Aided United Nations Shift to Offensive

DELIVERY of more than was promised, on one production assignment after another, has been American industry's contribution to the favorable military position held by the United Nations at the beginning of 1943.

Plunged suddenly into war 13 months ago, America needed weapons of so many kinds that the industry's only clear order had to be "Production —ahead of schedule if possible!"

The prompt response to this order produced planes, tanks, guns, ammunition and marine equipment in quantities beyond expectation.

As the turn of events in the conflict dictated changes in strategy, some plants have been asked to curtail production of items that were desperately needed a few months ago. Another change is that production is being more closely geared to actual schedules, for excess production of one item may now upset the balances of material supplies available for other items.

But, with a year of achievement behind it, the industry's ability to "beat the promise" still manifests itself when the occasion demands it.

Given the green light on steadily mounting needs of aerial combat and transport, most automotive companies are now "beating the promise"

By the end of 1942 automotive plants engaged in aircraft engine manufacture were from three weeks to a year ahead of promised delivery dates. Parts makers, almost all producing aircraft engine components, are now generally delivering more than expected

The automotive company which was the largest builder of Liberty motors in the last war succeeded in producing 1½ times as many war engines in 1942 as it did during the entire period of World War 1 Current production of the company's aircraft and marine engines is now at a rate of $1,000,000 a day and this is expected to double during 1943 The firm finished 1942 three weeks ahead of engine schedule.

Propellers, which threatened to be the bottlenecks of warplane production, have been coming off automotive lines ahead of schedule for months.

In one case, an automotive company contracted to make a few hundred propellers a month. Before the plant could be tooled, the order was increased three-fold. A little later, demands for a 20 per cent increase necessitated the tooling of a second plant. Though ten times the size of the original order, this program has now been increased another 40 per cent.

Recently, when a sudden need for a new type of marine communications device developed, several firms were asked to design and build working models. One, an automotive parts manufacturer, solved all engineering problems, got approval, and started tooling for production in two weeks.

In December, an automotive manufacturer of tanks turned out in the single month more 30-ton tanks than in the entire year of 1941.

Though some production lines are now being slowed down, others are being speeded up, and the automotive industry as a whole may be expected to continue to increase output of war goods.

Automotive Firms Lead In Utilizing Plants Fully

UTILIZATION of productive facilities on war work by the automotive industry topped all other industries during October, it is revealed in a survey of leading industries by the Office of War Information.

The survey showed that the automotive industry's working week on war production averaged 10 per cent greater than any of the other industrial categories in the manufacturing and transportation fields.

Throughout most of 1942 the industry's utilization of facilities has been intense, holding new plant construction to a minimum.

AUTOMOTIVE WAR PRODUCTION

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HARRY A. WILLIAMS, Editor

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Scrap-Salvage Plan Nets 700,000 Tons

Industry Total Equals 20,000 Medium Tanks

ENOUGH METAL SCRAP to build more than 20,000 medium tanks has been recovered in automotive factories and returned to processing plants in the first six months of the automotive industry's concerted salvage program.

The latest report issued by the Automotive Council for War Production shows that in six months the industry collected 1,433,856,315 pounds of metal scrap.

Of this total, iron and steel accounted for 1,349,931,520 pounds, the remainder being non-ferrous metal.

While cuttings and turnings made up the bulk of the scrap, a total of 154,383,662 pounds came from such non-production scrap as discarded tools, dies, machinery and other working equipment that was unfit for war work.

In these six months of continuous housecleaning in the industry, automotive companies authorized their vendors to release more than 9,000 tons of idle equipment to the nation's scrap pile.

The scope and nature of the industry's salvage activities are indicated by the Council's November report, which itemizes the month's scrap recovery as follows:

Iron and steel	236,856,541 lbs.
Aluminum	6,884,796 lbs.
Copper and brass	9,112,697 lbs.
Other metals	1,583,683 lbs.
Rubber	479,649 lbs.
Miscellaneous non-metal	3,248,683 lbs.
Scrap released at vendors'	2,900,620 lbs.

One automotive company reported to the Council that by authorizing the scrapping of aluminum molds, it released enough high-grade aluminum to fill five and one-half railway freight cars.

Another company, having converted its plants from automobile body to arms production, reported that its scrapping of such dormant equipment as conveyors, machinery, pipe, buildings, exhaust stacks, steel rails, etc., had netted 5,000,000 pounds of non-production scrap in October alone

Motor Trucks Provide U. S. Troops Overseas With Laundry Service and Shower Facilities

JUST AS MOTOR VEHICLES are performing thousands of essential services on the home front, they are proving indispensable in the field.

In addition to having combat vehicles of many types on every fighting front, the Army is utilizing trucks to provide American soldiers overseas with the same opportunity for cleanliness as they had in their homes.

Recently ordered from automotive companies, for instance, were more than 1,200 mobile laundry units, which contain all the necessary equipment.

Mounted on a semi-trailer and hauled by a truck tractor, these units are equipped with a washing machine, an extractor to remove surplus water from the washed materials and steam-heated tumblers for drying.

Each individual semi-trailer is a complete unit in itself, and each is capable of taking care of 125 pounds of clothing per hour. Sixteen of the mobile laundry shops can serve approximately 48,000 men per week.

Similar is the mobile sterilization bath unit that is also mounted on a single semi-trailer Its equipment consists of a steam-sterilizer, showers, and four tents for the men while dressing and undressing

These units are just two examples of the many special uses of military vehicles in the field. They are performing virtually every function required by a stationary, home Army Illustrating the military value of motor trucks is the fact that more than a half a billion dollars' worth were ordered in the past year.

On the home front, too, commercial vehicles are handling hundreds of tasks, important to a nation at war. They are hauling raw materials to plants, connecting sources of supply of semi-fabricated materials, and delivering finished products. They are proving as vital to war production as any machine in the factory or any part of the assembly line.

Automotive Workers' Wages At Record Level in 1942

AVERAGE WEEKLY wages of employees of former motor vehicle and body manufacturers exceeded $52 in the first 11 months of 1942.

This is the highest payroll figure in the history of the industry. During 1941, the peak peacetime year of the automotive industry, average weekly wages ranged from a low of $37.96 in January to a high of $46.47 in June.

Currently the automotive worker is receiving an average wage rate of $1.20 per hour for an average work week of 46 hours. This compares with a high mark of $1.15 an hour for 37 hours worked in December, 1941.

In November, 1942, latest month for which figures are available, average weekly wages of automotive workers totaled slightly higher than $55.

Automotive Engineers Combating Effects Of Sub-Zero Weather on Army Equipment

ENGINEERING know-how that eliminated the tea-kettle and tow-rope as standard winter equipment for American motorists is now being applied to the job of keeping tanks and Army trucks running in sub-zero temperatures.

Utilizing the research laboratory "cold rooms," established in peacetime to study car starting problems, automotive engineers have worked for months on electrical systems which will function in Russia, Iceland, Alaska and on other frigid fronts.

Working closely with Army engineers, automotive specialists also have developed methods for improving starting and steering, for protecting electrical systems from extreme cold, and for heating engines and batteries.

Unlike cautious motorists in Maine, Montana and other cold areas who in sub-zero weather may have transferred batteries at night from the car to a position near the base burner, the Army must have quick starting without resorting to any such measures. Batteries stay with the Army's motorized equipment at all times, even though the trucks and tanks remain inactive for weeks in temperatures ranging down to 60 below zero.

The automotive engineers undertook the assignment of providing a quick starting system for the Army early last March, in anticipation of winter fighting on various Arctic fronts.

Under the direction of the SAE War Engineering Board, the manufacturers of tanks, combat cars and military vehicles have pooled their knowledge to work out the most effective system. As various recommendations were received, the automotive specialists conducted tests in the industry's "cold rooms," where Arctic conditions could be simulated.

To get first-hand information on actual running tests, the engineers, in addition, are making other observations at a winter test base in one of the coldest areas of Canada. This base, established by the United States Army, is equipped with a machine shop, welding equipment and other maintenance supplies. Many types of tanks and military vehicles have been shipped up for the test.

One of the most difficult problems to be tackled at the camp is that of lubricating both engines and chassis in extreme cold. Attempts are being made to develop a lubricating oil with a pour point low enough to eliminate the need for dilution.

Some idea of the frosty conditions encountered can be gained from a listing of the wearing apparel which automotive engineers take to the Canadian camp.

Two suits of long woolen underwear; three weights of socks; ski boots; muck-a-lucks; snow packs with wool lined rubber feet and leather uppers; two pairs of ski pants over which socks and boots are worn; at least two heavy wool shirts; ear muffs; wool helmet that tucks in, covers the face, and has slits for the eyes; fatigue cap; gloves—heavy woolen mittens, finger and leather gloves; goggles; parka; and heavy turtle neck or V-neck sweaters.

Thus attired, engineers are now conducting field tests of theories that have survived the punishment to which they were initially subjected in laboratory "cold rooms."

The benefits of such research are not confined to the Arctic, however. For the lessons thus learned are often valuable in the tropics.

Airplanes, for example, are now being built with self-contained and often fully automatic mechanisms which enable them to take off in tropic temperatures, where cooling is the essential problem, and climb quickly into the substratosphere, where sub-zero temperatures prevail.

In this connection, one of the major contributions has been the extension and refinement of that branch of automotive research which produced car heaters for American motorists.

It is not at all a remote possibility that such research will, with the return of peace, produce undreamed-of advances in that contest which mankind has waged with his climatic environment ever since the first primitive human huddled around a bonfire.

Cold-room testing solves problems.

AUTOMOTIVE WAR PRODUCTION

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They were expendable . . . the assembly lines, capable of turning out a car a minute, a truck every few minutes.

Sacrificed to war production, the uprooted facilities no longer replenish the civilian supply as they did in peacetime.

But minutes are *not* expendable. Time is precious and the automotive plants are making the most of it. With every tick of the clock precise, intricate weapons for the fighting forces stream off automotive assembly lines. $1,000,000 of war materiel an hour—$20,000 a minute—that's the production rate that the automotive industry is fast approaching.

Though severed for the duration from the blood stream of production, the great civilian economy built around highway transportation is continuing to fill a major roll in wartime. Passenger cars, linking home and factory, are proving indispensable in getting war workers to their machines; trucks are doing many a vital job, from hauling food to assuring supplies to meet plant schedules; dealers are performing laudable service, maintaining the rolling stock of motor vehicles so essential to the nation's daily needs.

And as the $1,000,000-an-hour volume floods out of the automotive factories, it brings the nation a step nearer the day—Victory Day—when the worker, the supplier, the dealer, the truck operator, the service station attendant, the tourist-home owner, the farmer and many others can start rebuilding a prosperous economy upon the foundations of highway transportation.

THE AUTOMOTIVE INDUSTRY

In War and Peace

From the automotive industry today war materials are pouring forth at a rate which will soon reach a million dollars an hour.

When the statistician cities such a figure just what does he mean by *automotive* industry?

To the contracting services, it is "the powerhouse of the arsenal of democracy." To the mechanized division commander, it's the source of his armored cars, his tanks and his trucks. The Air Corps pilot may think of it as the birthplace of his high-speed, efficient airplane engines. The marine in the Solomons knows that his jeep, his helmet, his amphibian tank hailed from the automotive industry.

One motorist thinks of it as Detroit, South Bend or Kenosha. Another as Flint, Lansing or Toledo, or some other city where he went to take delivery of his car or truck, his bus or trailer.

Yet, the cities that rolled out the finished motor vehicles in peacetime and the ones that ship the finished tanks, guns and airplane engines in wartime are only part of the industry. For the automotive industry reaches out to 31 states and embraces nearly 1,000 manufacturing plants engaged in automotive work in war and peace.

And that's only a partial list, for while it includes the major parts makers, equipment makers and other sub-contractors to the automotive industry, it doesn't include them all. The list has expanded since war began, taking in many an obscure little company which only in recent months has supplied automotive prime contractors, responsible for the final war product.

In scope of its work, the automotive industry is BIG business, but in composition it is mainly SMALL business. As Major-General Levin H. Campbell, Jr., chief of Ordnance, said in a recent address before an automotive industry engineering meeting in Detroit:

"One source of gratification to us in Ordnance is the fact that you have so widely subcontracted among the small business institutions of the country. By this means you have done much to foster and keep alive the small shop which is representative of the small independent business in this great country."

But the periphery of the automotive industry goes beyond the companies that make the axles, the valves, the wheels, the thousands and one other "bits-and-pieces" which flow into the plants that assemble the finished product.

It includes also the companies that make the tools—the towering machine tools, the delicate gages, the precise jigs and fixtures, the intricate dies. In the tool-and-die industry alone (see pp 4-5) the shops have mushroomed during the war period, and the plants now in business are three times greater in number than ever before.

Nor does the automotive industry stop at the gates of the manufacturing and tooling plants. The lifeblood that it has supplied in the way of new products in peacetime has nourished a great civilian economy, which in peacetime, provided paychecks for 6,500,000 men and women.

In peacetime a large portion of the above jobs—1,307,000, in fact—was found in the sales and servicing of motor vehicles. The war has, of course, made great inroads on the servicing end particularly, with the Army taking many skilled mechanics as technicians for armored divisions and for aircraft maintenance work.

Automobile dealers — there were some 40,000 of them in peacetime— have been the factories' representatives in all the major communities, where they have performed a valuable

Heading overseas to keep U. S. tanks and planes in operation.

From the automotive industry: transportation for the South Pacific.

national service in keeping the nation's 26,000,000 cars and trucks in running condition. These alert, enterprising small businessmen found they had no new merchandise coming in to replace existing car stocks when production was suspended by government order. Yet by concentrating on their service and repair departments and by taking on sidelines, nine dealers out of ten have stayed in business despite the upheavals of war.

A most vital, dynamic segment of the motor industry is found in the highway transport field, with its vast corps of motor truck operators and drivers. In a wartime economy calling for quick and flexible deliveries, motor truck movements have assumed great importance in helping factories meet tight schedules. War, of course, has thinned the peacetime ranks of the 3,665,000 motor truck drivers, thereby putting increased demands on the men who haul war materials. But the goods are rolling over the highways from supplier to war plant with efficiency and dispatch.

Trucks, too, are contributing greatly to feeding the nation. Fortunately, there are seven times as many motor trucks on farms today as at the end of World War I, a situation that has helped alleviate to a degree manpower shortages in various agricultural areas.

For the past two decades, a marked opportunity for economic development has existed in the highway transport field, a section of the American economy where initiative and enterprise has been pronounced. Alert to new markets, motor truck operators have functioned as economic explorers, performing a much needed service. For example, trucks rolling up from Florida and other Southern states have lent to America's diet a diversification that was unknown only a few years ago. Strawberries, melons, citrus fruit and many types of perishable foods have come to many dinner tables only because of quick, inexpensive truck transportation.

Yet food comprises only one of thousands of products that trucks are hauling cheaply for the American consumer. As the Federal Coordinator of Transportation said several years ago:

"By bringing about lower transportation charges, particularly on short hauls, and by forcing reduction of rail and water rates, it (motor transport) has put tens of millions of annual savings into the pockets of users of the transported articles."

The passenger car, too, exercised a decided economic influence in America in the years following the first World War. By giving the consumer a tremendous mobility, it expanded the effective radius of trading centers and sharpened the competition between rival cities.

Combined with the truck, the automobile helped lift the nation out of the mud and created opportunities for jobs and better living unparalleled in any two decades in history.

The Main Street merchant, the filling station operator, the road builder, the back street repair shop, the tourist home at the edge of town—all benefitted from the surge of economic activity which automobile travel generated.

At present, of course, this and other segments of the American economy are operating at a reduced acceleration, thousands of citizens having gone to war, others transferred to war factories. But there is vitality in this sector of the automotive industry, and with the return of peace, the outlook is for a powerful resurgence of activity —and jobs again will be created.

The motor transport industry has created jobs for millions.

HOW IT'S DONE

No. 1—The Tool and Die Industry

A segment of the automotive industry, composed of small enterprising shops —tripled in number since the outbreak of war—that has contributed much to the unprecedented production of war materials.

A very precise production job leads in a tool shop.

IN ANY FIELD of human endeavor, there are always thousands of unsung heroes—those men whose lot it is to remain in the background, constantly doing a steady, efficient job, but seldom receiving much credit.

On the industrial scene in America, whether it is peacetime or wartime, the tool and die companies that have been serving the automotive industry for more than two decades are a good example of unsung heroes. Their names are not inscribed on any automobiles or on any of the weapons of war that automotive companies are producing, yet they provide the very ingredients that make the finished product possible.

In attaining mass production of any item, for instance it is essential to provide the means for making parts so exactly alike that they will be interchangeable. This calls for thousands of machines and tens of thousands of machine accessories—tools, dies, jigs, fixtures and gages. The latter implements are the responsibility of the tool and die industry and they must be on hand before mass production can begin.

Thus, when automotive companies were swamped with orders after Pearl Harbor for tanks, guns, ammunition, aircraft of many types, marine equipment and hundreds of other items, a tremendous load was placed on the tool and die industry.

In some circles, there was apprehension as to whether there were sufficient tooling facilities and enough skilled labor to make the thousands of necessary tools, dies, jigs and fixtures.

In the automotive industry, however, there was none. For having dealt with these small, independent manufacturers for more than twenty years, automotive men were familiar with the ability of tool men to handle all jobs—large or small, simple or extremely complex.

And the automotive industry encouraged tool and die firms to increase their facilities when, early in the defense program, orders for war materials were being received on a small scale. In addition, new plants began sprouting up in automotive cities, as other skilled men anticipated a demand for their talents in the coming war program. Tool shops serving the automotive and related war production industries have tripled in number during the war period.

The tool and die shops assumed the status of an industry at the end of the first World War, when competition between automobile manufacturers became fiercely intense. This drive to gain the consumer's favor found yearly model changes being made, thereby creating large tooling orders that could not be handled with the limited facilities in plants of the major automotive companies. Thus, outside help was needed, and small, modest establishments began to be set up.

Aptly described as "independent" shops, these companies are monuments to the traditional independence of the American craftsman—and to the American way of life which permits such free expression of human enterprise.

Virtually all were founded by men who, employed in automotive plants, possessed that combination of inventive ingenuity, alertness to opportunity and willingness to take risks which the launching of a successful venture requires.

Usually they started as one-room shops, in basements at home or in back-alley garages. Small, staffed with highly skilled and boldly venturesome craftsmen, they were extremely adaptable to varying needs. When conditions demanded growth they enlarged their quarters and increased their facilities. And, though still relatively small when war came, their staffs of master craftsmen were ready to handle the tremendous tooling job required to get the automotive and other industries into war production with least possible delay.

For example, there is the case of the four brothers who, after saving up $5,000 between them, decided to go into business for themselves. Leaving an automotive firm which employed them, they devoted their first weeks to putting a roof over their enterprising heads, building their first shop entirely by hand. Then, taking on jobs from automotive firms, in which they did all the work themselves, they gained a reputation as excellent workmen.

More and more work was forthcoming, which necessitated the hiring of new workers. And, by sticking to a policy of plowing profits back into the business, the shop grew stronger year by year in the face of intense competition. Two years before war broke out, the four brothers built a modern factory, installed the latest type equipment, and had a capable, experienced organization geared to perform a variety of jobs.

Today, their war work tops any peacetime year by more than 50 per cent. For more than two years, this plant has been running two ten-hour shifts seven days a week. Of the 200 employes of the company, over 100 received $5,000 or more in wages during 1942.

In another instance, the men of one family becoming highly skilled in automotive tool rooms, set out on their own in a small shop. Unable to afford outside help for the first few years, their womenfolk handled all the office work and even volunteered to take on the menial task of cleaning up the small plant.

This enterprising family now holds an enviable position in the tool and die industry. Their plant has grown to be one of the outstanding ones serving automotive companies and, equipped to meet the challenge of greatly increased production when war came, they are today handling important war jobs for more than a score of manufacturers.

Most of the men who left automotive tool rooms to open their own shops did so because they saw the need for specialists in some particular phase of the tooling field. Some, as in the above examples, branched out into general shops while others remained as single-purpose outfits.

One such case was the company that set out to make gages for the precision work in automobile manufacture. Sticking to this throughout the years it built up facilities until it was one of the major suppliers of gages to automotive companies. With the greatly expanded precision requirements of airplane, gun ammunition and tank manufacture, these gage facilities proved essential when war materials were needed so desperately. This firm today is one of the largest gage producers in the United States, with over 450 employes working round-the-clock, seven days a week.

Another that proved invaluable in war work was a company that specialized in large sheet metal dies in automobile days. This firm, that had built up its facilities to include giant cutting machines, planers, and boring and turning mills, converted its entire shop over to making tank turrets and other huge parts, when tanks were needed on a mass production scale.

Not only did this band of men have the ability and initiative to step out on their own, but they also demonstrated ingenuity in keeping their shops busy during the slack periods of automobile manufacture.

One company, for example, bought some scrap sheet steel and, utilizing its existing equipment, developed a special type coat rack. These were then distributed through various retail stores and were sold to restaurants and other similar public gathering places. While they were not much as profit items, they did keep more than half of the shop and its employes busy.

To help alleviate the critical shortage of skilled workers, the tool and die industry put into effect an upgrad-

(Continued on Page 6)

Special die shown above, banded production of vital aircraft parts.

War work requires countless gages

Die makers are highly skilled.

JIGS AND FIXTURES are holding devices. The principal variation is that a jig locates and accurately guides tools during machine operations, whereas a fixture firmly holds in place material to be machined.

TOOLS are the implements of machines. They do the actual work of cutting, drilling, shaving, milling, etc.

DIES are metal blocks with the pattern or contour of a part reproduced on their surface. They are used in presses or forging hammers for forming identical metal parts.

GAGES are devices for accurately measuring the dimensions of manufactured parts. They determine whether or not the dimensions are within specified limits.

Little People Play Big Role in Production Of Bullet-Proof Gasoline Tanks for Aircraft

Only the compact need apply for work on inside of bullet-proof fuel tanks.

THE SECURITY of America's fighting aircraft, their pilots and crews, lies in the hands of little people—those men and women of short stature and small girth who are able to squeeze into tight places.

They are performing unique war tasks in the manufacture of self-sealing, bullet-proof gasoline tanks which, as everyone knows, have already been responsible for saving hundreds of lives of fighting men of all the United Nations.

At an automotive plant where these leak-proof fuel tanks are being made, for instance, such sylph-like individuals have been hired for the specific purpose of crawling inside a small opening to inspect and put the finishing touches to the interior of the tank.

The fuel tanks are manufactured by a method that calls for construction of the cell over a papier mache form, held together by a plaster cast. After vulcanizing, the plaster forms are broken by striking the outside of the cell with hammers. Fragments are then dumped out through the small openings.

After this operation it is essential for workmen to crawl into the cell to thoroughly inspect the inside surfaces and to make sure that every piece of plaster has been removed. Even the smallest particles, should they clog the fuel line to the engine, might be enough to cause a four-motored bomber to crash to earth with its valuable crew.

Using a special tool, much like the one used in repairing inner tubes of motor vehicle tires, the small workers smooth out the inner surfaces, removing any projections that might drop into the fuel.

Even when an aluminum form is used instead of the plaster cast, it is still necessary to employ the little people. With this method, the form is built into small sections and must be bolted together before the rubber can be built around it.

Thus, when the aluminum sections are removed after the tank is completed, the small workers must crawl inside, loosen the bolts, break down the segments of the form, and hand them out the small openings piece by piece.

This is not the only plant of the automotive industry where small-statured workers are being utilized in war production. Several companies, producing aircraft sub-assemblies, have employed such people as riveters, since their size permits them to crawl into tight corners of fuselages.

How It's Done

(Continued from Page 5)

ing system, whereby men with mechanical inclinations were brought into the plants to stand by a machine until they had learned to operate it. Thus, these men are trained in a single operation of the trade, rather than the full cycle of a journeyman tool and die maker. While only a wartime measure, this plan eliminated the drawn-out apprentice system.

A major contribution to the cause of the United Nations which generally is overlooked is the vast amount of work that the tool and die industry contributed to the industrialization of Russia. Thousands of tools, dies, jigs, fixtures, etc., were made for the Russian government and some of the tool companies even sent their crack engineers abroad to get the work going and to set up training systems.

Because of the wide experience gained as suppliers to the automotive industry, no task that has come along during the war period has been too difficult. And, in the habit of meeting stiff delivery schedules in peacetime, the tool companies have been able to turn out the unfamiliar tools of war in remarkably fast time.

This ability to do a job right and do it quickly is one of the major reasons why many of the large aircraft companies have placed large orders with automotive tool and die companies.

As one exuberant aircraft official said recently, after getting a quick delivery promise on a vital tool order, "we offered this job to a tool firm in our neighborhood and they wanted a week to study the plans. You fellows will deliver the job in a week. That's the kind of service we've got to get, if we're to meet the Army's requirements."

While the names of these firms aren't inscribed on any of the tanks, guns, planes, engines, etc., a tremendous job has been done and it will continue until that final day of victory. And, as is typical among unsung heroes such as these, they won't be lauding themselves when the struggle finally ends. For they will be hard at work again, preparing the machines of industry to turn out products of utility rather than weapons of destruction. It will be the tool man who will be the determining factor in the length of time it takes before automobiles, washing machines, radios, vacuum cleaners and a host of other items will be available for the consumer.

New Tank, Equipped with 105 mm. Cannon, Helped to Rout Rommel's African Forces

Heavily armed, highly mobile, M-7s were more than a match for Nazis.

WAR BEING a notoriously extemporaneous art, the best generals and admirals are those who take risks which may be mistakes but who rectify their mistakes with the least loss.

One morning last May Field Marshal Erwin Rommel made a mistake, rectified it and, by that afternoon, had launched a drive that drove the British Eighth Army back almost to Alexandria. The correction of the mistake which the British made that day resulted in a weapon which played a major role in history's longest chase the recent 1,300-mile retreat of Rommel's *Afrika Korps*.

That weapon is the United States Army's 105 mm. Howitzer Motor Carriage M-7, a modification of the highly mobile M-3 Medium Tank, which was developed by officers of the Army's new Tank Automotive Center, established in Detroit to coordinate production of ordnance in the automotive industry.

U.S. Army Ordnance development engineers were hard at work on a secret tank-destroyer when the news of Rommel's success reached them last summer. The reports from United States observers at the front to Army G-2 headquarters in Washington were alarming.

They told of how Rommel, opening an offensive, had sent his tanks south in a sweep around Bir Hacheim, to outflank the British line. His intended surprise detected and his columns attacked by superior forces, he corrected his mistake by feinting while his engineers cut a gap in the heavily-mined Ain el-Gazala line. Ringing this gap with hidden batteries of 88 mm. cannon and pushing his forces through, Rommel drew the British troops into an ambush and destroyed 230 of their 300 tanks by the end of the day.

Though this tactical triumph did not constitute an indictment of the quality of U.S. tanks, as was generally alleged at the time, it did spur the development work in the Tank Automotive Center

To neutralize the Nazi 88's, a large caliber gun as mobile as a tank and capable of firing high explosive and armor-piercing shells was advocated.

Within 16 days production layouts for a new weapon, that combined these qualities, were drafted. Three weeks later the first models were at Aberdeen Proving Ground for tests. Shortly thereafter the new weapons were being slipped into Egypt for the Eighth Army, then being prepared for the recent drive under the leadership of General Sir Bernard Law Montgomery.

Introduction of M-7 was so secret that its appearance on the Libyan front was a surprise to the British soldiers themselves—to say nothing of the Nazis. With their high speed and long range, they were the first weapons of their kind in the world.

Lighter in weight than most tanks of their size, they are capable of a speed of 35 m.p.h.—10 miles more than the speed of M-3's from which they stem. Their 105 mm. howitzers, capable of shattering objectives at distances of seven miles, crumpled Rommel's Panzer divisions and dissolved his fixed lines. Even when the retreating Marshal tried to hold the British back with heavy artillery, these American-made guns, with their high-velocity ammunition, outranged the German guns.

The manner in which this weapon was produced in a remarkably short time after its need arose is a tribute both to the ingenuity of American military minds and to the adaptability of American industrial skills. Both are results of constant refinement under the impacts of that competition between teams which Americans prefer in the class-room or the market-place, in school and shop, on the playing-fields and on the battle-fields.

War Bond Purchases High in Motor Plants

WORKERS of the automotive industry are backing up America's fighting men by purchasing war bonds at an annual rate of nearly a quarter of a billion dollars.

A recent survey of automotive plants reveals that at least 10 per cent of the income of production and office workers of companies representing more than 85 per cent of the total payrolls of the entire industry is being invested regularly in war bonds. Other plants of the industry report that their employes are rapidly approaching the 10 per cent figure and they will soon be qualified to receive the "Minute Man" pennant of the United States Treasury Department.

As shown by the survey, there was a steady month-by-month increase during the past year in the amount of money being allocated for war bonds. Also swelling the total investments in war bonds and stamps by workers of the automotive industry are the direct purchases, over and above the payroll plans of automotive companies.

Automotive Technique of Progressive Assembly Adapted to Manufacture of Aircraft Wings

LARGELY BECAUSE American manufacturers of automobiles and motor trucks were its most conspicuous users, the power-driven assembly-line became the dramatic symbol of U.S. mass production in peacetime.

This dynamic method of manufacture has now been applied to aircraft fabrication as wings for Flying Fortress bombers and Thunderbolt pursuit ships roll off conveyors in a plant whose peacetime product was automobile bodies.

Significance of this achievement is that it speeds production of bombers and fighters at a time when needs for these weapons are paramount.

The adoption of moving conveyor lines puts into effect progressive assembly of all component parts. This is the step-by-step process whereby raw materials are transformed into parts, parts into subassemblies, subassemblies into the finished product, all in a continuous coordinated flow.

In peacetime, a marvel of the industrial age was the dynamic growth, in mere minutes on an assembly line, of a bare frame into a complete automobile—ready to roll out the plant door under its own power.

As it traveled along the line, the frame picked up axles, wheels, fenders, crankshaft, body, motor and a host of other pieces. It was a precisely timed flow of materials, each unit built to exact specifications on subsidiary assembly lines and each fed into the main assembly line at the precise moment when an assembly worker reached for it.

The constant refinement of this planned precision manufacture-in-flow, with its accompanying improvements of the rate of production and reductions in cost, was chiefly responsible for broadening the scope of the passenger automobile from a luxury "pleasure" vehicle for the few into a transport necessity for the millions.

Not satisfied with production efficiency on one of its aircraft jobs nearing completion, production experts of the former body company, called upon to make wings for B-17s and P-47s, decided to incorporate automotive principles in the new job.

Charting a plan whereby all constituent parts of the wings could be made to flow together in continuous movement along a series of conveyor lines, the automotive company submitted it to Army authorities and received approval to put it into operation.

Two floors are being used for the progressive assembly of small parts, with the heavier assemblies being completed closer to the final assembly floor. This practice, customary in motor car body manufacture, saves excess movement of large pieces and heavy sub-assemblies. The products of the two floors then converge on still another floor, where the many assemblies are tied together into heavier subassemblies and finally riveted into the completed wing.

The unique part of the system is the use of moving jigs suspended from overhead conveyors. These jigs, which hold the product, travel in a steady stream from workman to workman, until all parts are installed and the subassemblies are riveted into the complete wing.

Through this system, it is therefore possible to train workers in single skills rather than the full cycle of operations required when material is positioned in conventional jigs and fixtures.

Until overhead conveyors were put into use, it was necessary to do all riveting and assembly work in flat jigs to prevent the wings from getting out of plumb.

Now the wings are carried along edgewise, saving about 40 per cent in floor space. This factor—the saving of factory space—played a major part in winning Army approval.

Another benefit is the elimination of time formerly lost in continuous changing of plane parts from jig to jig or fixture to fixture. And, since it gears all attendant functions, such as material handling, maintenance and inspection, into the cardinal production operation itself, it constitutes an approach to those manufacturing methods with which minds and hands of the automotive industry have mastered through long years of familiarity with planned work that works exactly as planned.

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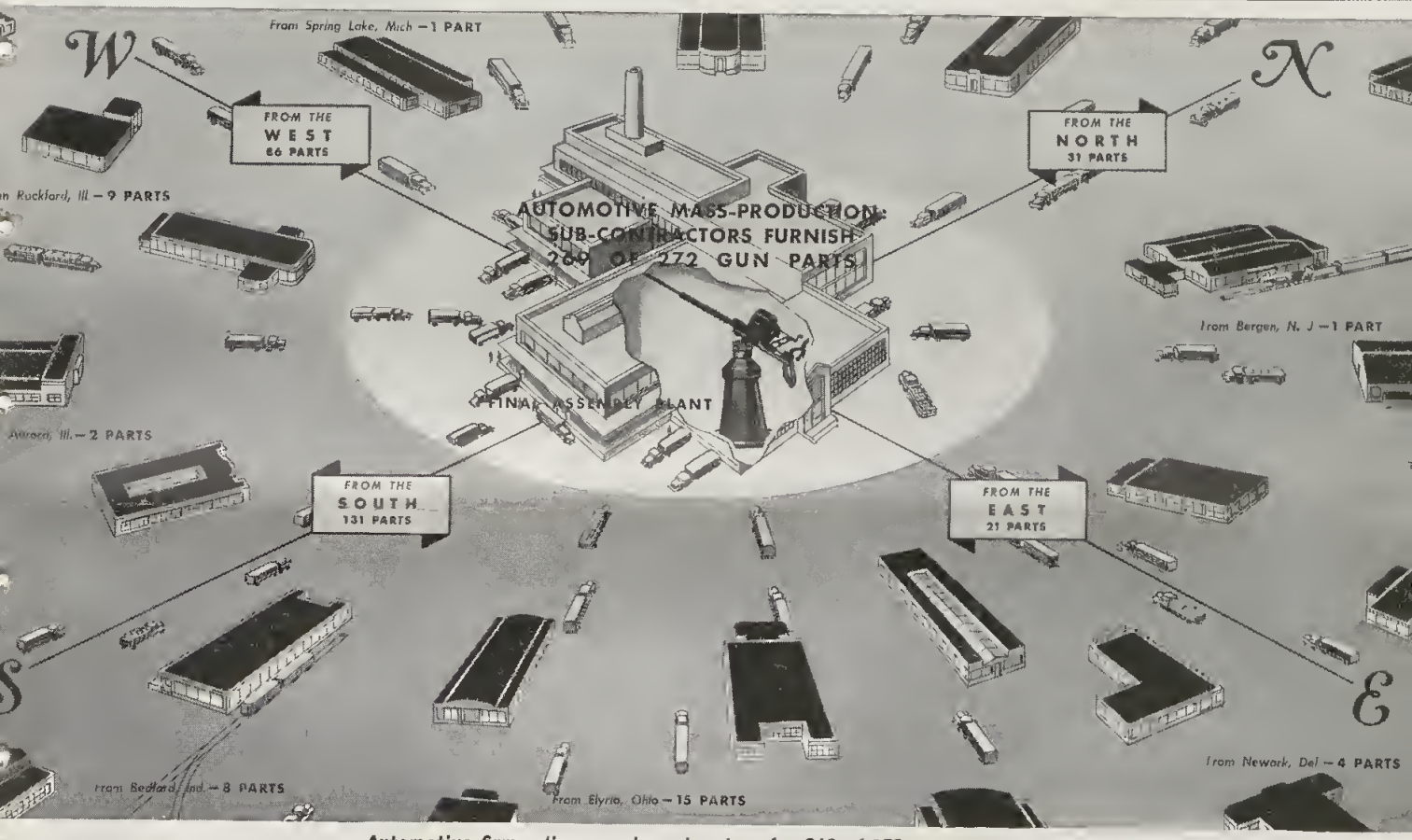


Automotive firm relies on sub-contractors for 269 of 272 gun ports.

Small Firms Are Essential to Automotive War Job

Motor Plants Enlist Specialized Talents of Thousands of Widely Dispersed Enterprises

WHEN THE HISTORY of this war is written it may well turn out that the Waterloo of the twentieth century's peace-disturbing corporal stemmed from the sandlots of America. For, time and again in reports of American successes on the fighting fronts, the dominant note has been the recurrent one of triumph through teamwork.

In America's present crisis, this habit of teamwork highlights our nation's war effort, from the fighting fronts all the way back to the factory fronts.

In the teamed production of weapons by the automotive industry, for example, there is a remarkable resemblance to that pattern of organized team-play which is America's favorite sport—baseball.

For in organized baseball in the United States, 16 teams, concentrated in less than a dozen cities, receive most of the public attention. Often forgotten is the fact that the members of these teams almost invariably come from other teams in minor leagues, which, in turn, draw their strength from sandlot teams in little-known communities throughout the 48 states.

The same situation exists in the automotive industry. While major public attention is accorded a few familiar companies in less than a dozen cities, it is usually forgotten that these "big league" teams rely for much of their strength upon a system of "minor leagues" of little-known sub-contracting companies throughout the 48 states.

Sub-contracting is but a wartime word for a common peacetime practice of the automotive industry. As with all other phases of the traditional American habit of team-

(Continued on Page 2)

AUTOMOTIVE PRIME CONTRACTOR

WAR PRODUCT	NO. OF PARTS MADE BY MOTOR COMPANY	NO. OF PARTS MADE BY SUB-CONTRACTORS
TANK	1500	3000
GUN	428	522
BOMBER SECTIONS	5661	5881
ARMY TRUCKS	1318	3783
GYRO-COMPASSES	103	303

Small Firms Aid Automotive Industry

(Continued from Page 1)

work, war has intensified its application to the nation's critical needs. But the pattern was ready for the crisis, and its use today enables the large companies to concentrate their more extensive facilities on the more difficult phases of production, while a host of smaller but highly flexible suppliers are entrusted with the production of thousands of different components of finished weapons.

Tools, talents and techniques were three big things the small manufacturers had to offer when war came. By enlisting these resources, the automotive industry eased the demand for thousands of machine tools and forestalled general manpower shortages in automotive centers.

To get the small shops into their war work programs, however, it was necessary for the prime contractor to assist the supplier companies in obtaining materials and in meeting Army specifications.

Of more than two billion dollars in war contracts now being handled by one large automotive manufacturer, more than $1,300,000,000, or 58.2 per cent of the total, is being sub-contracted to smaller companies.

These sub-contracts cover 8,079 individual companies located in 856 cities and 39 states. Of these, 4,690 are relatively small business concerns, 1,607 are medium sized, and 1,782 are large organizations. The number of sub-contractors sharing in the work of this automotive firm are more than five times those which participated directly with it in peacetime.

A former passenger car company is manufacturing in quantity four types of cannon, previously considered too difficult to sub-contract and too intricate for mass production. Yet, sub-contracting is the very key to the record it has chalked up as one of the finest armament makers in America.

In all, there is a total of 769 parts in the four cannon. Only 12 parts are made by the automotive company, while 757 (98.4 per cent of the total) are manufactured by sub-contractors. In seeking help on its gun work, the prime contractor received bids from 327 concerns, resulting in sub-contracts with 137 different firms located in 58 cities in 10 states—Delaware, Illinois, Indiana, Massachusetts, Michigan, New Jersey, New York, North Carolina, Ohio and Pennsylvania.

While a few had been suppliers to the automotive company in peacetime, the vast majority are small concerns that heretofore had never associated with the automotive industry. The size of the shops is indicated by the fact that more than 75 per cent of these sub-contractors employ less than 500 people each.

To familiarize a supplier with the particular gun piece he was asked to make, the automotive company furnished a photograph or wooden model of the parts. Surfaces of the photographed part were illustrated in different patterns, and these were keyed to a sample steel bar on which different finishes were shown. In addition, the prime contractor had a staff of technical and production follow-up men constantly on the road, assisting the sub-contractors in solving production or material problems, thus assuring a uniform flow of parts to the final assembly plant.

After Pearl Harbor, when a flood of war contracts was coming out of Washington, many companies experienced difficulty in locating competent sub-contractors.

One automotive firm, in "beating the bushes" to find suppliers for 60 of the 63 parts in a carbine it was to produce, had a man canvassing as far away as New England. As a result of his door to door search, he located many unusual suppliers. One of these is a company that formerly produced price tags for dry goods and department stores. A watch case company in Kentucky is making an ½ inch part that requires 22 milling operations. An automobile dealer was set up to make one vital part. A brick company was taught to anneal in its brick furnaces. A firm that formerly specialized in making tennis and badminton rackets is producing several parts.

As the general manager of the automotive firm declared, "it was like going to a bakery and telling the owner to put in a meat counter. Normally, you would go to a meat market."

By intensifying its sub-contracting another automotive firm, making Diesel engines for many types of Navy craft, has been able to increase production 24 times above peacetime levels, thereby placing hundreds of ships in actual service many months ahead of schedule. Its sub-contractors embrace 191 communities in 24 states and the District of Columbia.

Recently ordered to double its production of aircraft engines, still another automotive firm is expected to meet the new commitment largely through increased sub-contracting. Present plans call for the addition of only about 10 per cent to its machine tool requirements and 20 per cent to its labor force to accomplish the doubled output. Sub-contracting, however, will be increased from the current figure of half the dollar value of the contract to more than 75 per cent of the dollar value in the hands of outside concerns.

Automotive Industry Reducing War Costs Through Improved Production Techniques

EACH GUN $600 CHEAPER. Moss production efficiency enobles automotive firm to telescope gun cost.

TO GET THE billions required to supply our fighting forces all over the globe, the American public this month is paying increased taxes and every month is investing heavily in war bonds.

Mr. and Mrs. America, however, are not alone in their efforts in saving money so that the cost of the war can be borne. For, at the production front of the automotive industry many sizable reductions in the cost of war materials are being effected.

Take, for instance, the automotive company which, through voluntarily reducing its prices of war products to the government, was able to reduce prices by $169,178,141 on last year's production alone. This is equivalent to giving the government cost free 1,000 medium tanks, 200 torpedo boats, 2,000 anti-aircraft cannon (37 mm.) and 450 interceptor planes.

These price reductions were largely due to savings brought about through improved designs, improved and more efficient manufacturing processes, through saving of material and through substitution in some cases of equal or better but less expensive materials. In all, this firm delivered nearly two billion dollars worth of war goods during the year 1942.

For every 20 mm. aircraft cannon that rolls from its assembly lines, another automotive company is saving enough money to equip three soldiers with sub-machine guns. As output of the cannon increased, the company progressively lowered costs until today, at peak production, it is delivering the gun $600 below the original contract price.

On a high powered aircraft engine, used in bombers and fighter planes, still another company adapted automotive mass production methods to its manufacture and is turning them out in quantity at a reduction of $3,500 below the price set by Army engineers and auditors on the basis of small scale manufacturing practices. Thus, for every engine produced in this one plant, the savings are equivalent to the cost of approximately 20 life rafts of the type that kept Capt. Eddie Rickenbacker and his party afloat in the Pacific.

More than 140,000 jeeps could be purchased with the $123,000,000 in price reductions effected by an automotive parts supplier who is manufacturing scores of precision instruments for the armed forces. For a modern bomber, this company manufactures more than 150 different devices. Its current production is 20 times as great as pre-war levels.

Not only has the automotive industry been developing methods of reducing costs of war materials to the taxpayers, but it is also searching constantly for ways to cut down manpower requirements and for methods of conserving critical materials. In most cases, the natural by-product of such research is lower cost.

For instance, to combat the shortage of copper, engineers of one automotive company, working with a special Army-industry committee, developed a method which enabled large caliber shell cases to be made of steel. In addition to accomplishing its first objective—the saving of material—the automotive company has been able to bring costs down to a point where the same money will buy five times as many shell cases.

Changing the design, manufacturing methods or materials of 145 of 270 parts in a machine gun it was assigned to make, another firm has been able to increase production two and one-half times above that set by the War Department as normal and, at the same time, has reduced the cost of the gun by more than one-half.

By redesigning the shoulder rest on the anti-aircraft gun it is turning out, one automotive firm has been able to cut $45 out of the price of each. In addition, the new design has made it possible to have a fully adjustable rest, thereby permitting any size man to operate the gun. Heretofore, only small, slender men could squeeze into the tight space, since the rests were stationary and were built close together.

On an essential Naval unit that originally cost $30,000 apiece, another automotive company has been able to reduce costs by 37 per cent. When first placed on a production basis, its price was cut nine per cent. As volume of orders and output increased, the automotive firm, through improved efficiency, was able to effect five further successive price reductions. Current cost of these units is more than $10,000 below the original starting price.

On a bomber wing panel operation, time requirements were cut through the use of automotive-type machine tools and fixtures, enabling one company to save $1,000 in the price of the completed unit. Reaching mass production on an important aircraft accessory, another firm was able to effect a 30 per cent price cut. On another it slashed nearly 30 per cent from the original price and on still another price reductions totaled almost 50 per cent.

HOW IT'S DONE

No. 2

THE PARTS INDUSTRY

Adapting their peacetime-developed talents and facilities to the nation's war efforts, parts suppliers account for a big portion of the automotive industry's war production.

ARRAYED around the conductor in an orchestra pit are a hundred specialists, each chosen for a particular job, who by their combined teamwork produce a musical masterpiece from a diversity of instruments.

This musical team has its counterpart in the automotive industry, which in war production is creating a new world "symphony" by a similar collaboration of specialists.

The orchestration of industry runs beyond the walls of a single building and the plants of a single company It reaches out to thousands of separate establishments for their part in the final product. The success of the "symphony' of production depends on or

[illegible]zing the arrival of parts from cities towns and villages throughout America

In ever mounting tempo, the symphony of war production has risen to a $1,000,000-an-hour rate, due to the blending of thousands of parts manufacturers in making possible the finished score

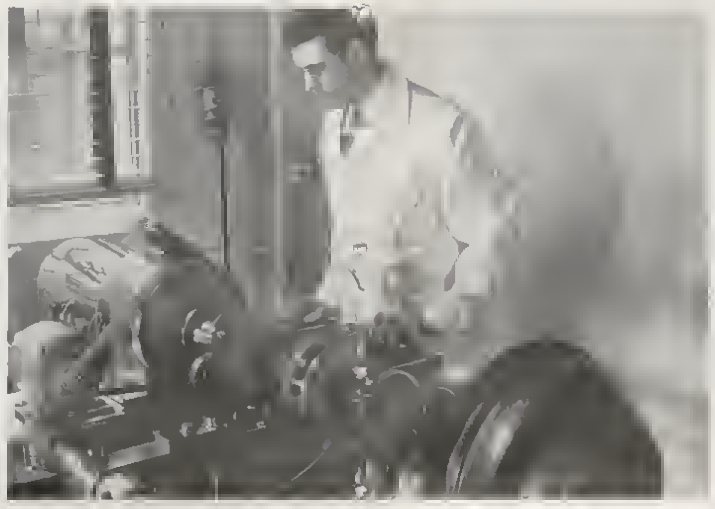
Parts companies in the automotive industry are, in the main, specialists concentrating on the manufacture of wheels or valves, axles or pistons, transmissions or windshield wipers or other such products

Their plants are spread over 31 states and hundreds of cities And beyond them are thousands of suppliers and sub-subcontractors, so that their industrial network embraces countless communities over the length and breadth of the nation

In the last year of peacetime, $718 000 000 of parts, equipment and accessories used in motor vehicles came from this great web of companies.

In wartime, the parts makers are making units that go into new tanks, guns, planes, marine craft and military vehicles, and, in addition, supply replacement parts needed in the servicing of the military equipment While exact figures are not available for all companies the totals for one group of parts companies showed that in 1942 sales reached nearly three billion dollars

After Pearl Harbor, the parts industry went beyond its familiar function as subcontractor and took on important prime contracts for guns shells, amphibious tanks, radio and radar equipment and other products Reversing a historic procedure, major motor vehicle manufacturers in some cases are now acting as subcontractors to parts makers



Specialized research programs of parts industry bring better products in both war and peace

In a sense the automotive industry grew up as the lusty child of the parts industry for, in the early attempts to build reliable passenger cars, the automotive pioneers drew heavily upon the facilities of buggy makers, wheelwrights, smithies, engine builders, foundries and sheet metal shops In fact, a number of motor companies hardly did more than assemble such units as engine body wheels, all of which were bought outside

The reputations of the parts makers were such powerful sales factors that, in early automobile advertisements, one car manufacturer boasted of 20 outstanding features, all made by and accredited to parts suppliers

Too, the practice of parts manufacturers in allowing their customers 90 days to pay for parts, carried many a pioneer automobile manufacturer to initial success This time lag was just long enough to allow automobile companies most of whom were operating with limited capital, to get cars into the hands of dealers, and thus make good on their indebtedness.

In risking their capital in such ventures the parts makers had a decided incentive—increased outlets for their products and hope of better profits

Typically, the parts maker stuck to his first invention down through the years and, through the application of his inventive talents, constantly refined his product and improved his processes Out of his relentless competition with other manufacturers, came most of the major improvements whereby horseless carriages evolved into modern motor cars

Out of the competitive race have come such improvements to the motor car as hydraulic brakes, automatic choke, hypoid gears, steel wheels shock absorbers heaters and air conditioners safety glass, accurate dashboard instruments, plastic steering wheels windshield wipers and numerous accessories

Having through years of peacetime competition built up important manufacturing facilities, staffed by competent workers many parts companies were ready to take on major assignments when war broke out Others though still small were equally well equipped with skillful and proficient personnel and they undertook intensified war activities in their fields

For a picture of a representative parts maker, consider the company that started out in 1919 with 20 employes and working capital of $25,000

After a temporary setback during the panic of 1920 1921 the company began to prosper Gradually expanding its facilities to accommodate more automotive orders, the company grew steadily until it attained its present position as the largest producer of engine bearings and bushings in the world

This firm is currently employing 6,800 on war work and soon this number will reach 11 000 During 1942, it produced nearly $25,000 000 worth of parts for military vehicle engines, aviation engines, Diesel engines and other ship propulsion units Present production schedules call for a constant increase in production until output of $90,000 000 per year is reached

Another company started in business 40 years ago with a single order for 25 sets of wheels Selling for $25 a set these wheels replaced the old sulky-type wheels, used on the first automobiles

Business was slow in materializing for this company until rim standardization was introduced to the industry To meet the new demand, this company had to install new equipment and increase its facilities And, to keep these facilities busy in slack seasons of car production it turned to other lines, producing oil burners and products in the agriculture and railroad fields When steel wheels came along putting its valuable wood working plants out of business, the enterprising management decided to make wooden whiskey barrels

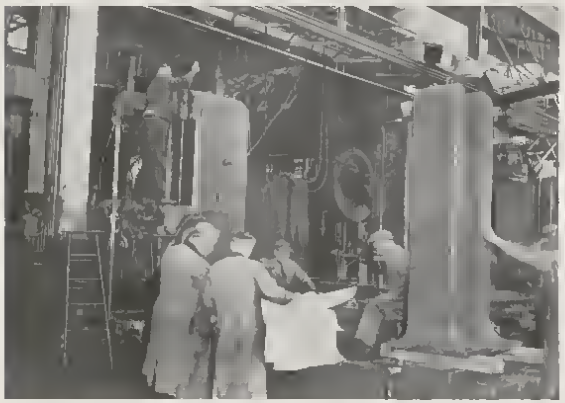
Interestingly enough two of the sidelines proved increasingly important when war came Thousands of oil heaters were sold to the government for soldiers in Alaska Iceland, etc and 80 000 whiskey barrels were recently purchased as containers for strawberry jam shipped to Britain

Its other products include projectiles for both the Army and Navy, 40 mm cartridge cases of which it is the largest producer wheels, hubs,

(Continued on page 6)

> "America was fortunate to have its powerfully efficient automotive industry when war came. That industry is the backbone of our Ordnance production now." . *Major General Levin H Campbell, Jr, Chief of Army Ordnance*

Mass production of weapons depends on groundwork plans of technical experts



Automotive companies' follow-up men keep in close touch with parts suppliers

Parts Suppliers, Specialists of Industry, Loom Large in Automotive War Production

(Continued from Page 5)

etc. for military vehicles which accounts for 30 per cent of its volume; bogie and idler wheels for tanks; gun parts; bomb parts; aircraft propeller domes; fuel tanks.

Another company, founded in 1901 to make tapered roller bearings for heavy-duty wagons, became a supplier to the automotive industry in 1909. To sell more bearings to automobile companies, it went into the manufacture of complete axles. Determined to get a solid footing in the young industry, the company moved from Ohio to a small plant in Detroit, which even then forecasters were terming the future automobile center of the world.

Originally starting out with a few hundred employes, this firm systematically plowed profits back into plant and facilities and prospered through the development of new products and new methods.

The reputation of this firm was enhanced by an incident in the early days of its history. Having submitted a bid and received an order from a large passenger car company for front and rear axles, the parts firm discovered to its dismay that in figuring the price, a costly item had been forgotten. Though this meant a serious loss, the company lived up to the letter of its contract, earning the respect of the entire industry. As a result many new customers were obtained.

Since 1931 this company has been working closely with the Army, building experimental front drive axles and transfer cases for all-wheel drive vehicles. When an urgent demand for motorization of the U.S. Army became a stern reality, tbis firm was already tooled up and actually in production of front driving axles and transfer cases for all sizes of vehicles. It has also played a major role in the development work on similar equipment for tanks. For the duration, this concern has granted to the government royalty-free license on more than 200 patents.

Still another firm had its beginning in 1918 with nothing more than a patent, a safe, a typewriter and unlimited ideas. Though possessing a patent for a new type engine manifold, the company was unable to secure enough capital to buy machines and other equipment; so it turned the production job over to a specialty manufacturer. From the small profits resulting from the first invention, this firm, operating with a one-man research department, developed a series of other new products. By 1923 it was able to build a small plant and begin its own manufacture with 25 employes.

From the fertile brain of its research man, the firm built and marketed several items that have resulted in improved automobiles. One is the accurate gasoline gauge found on most cars today, which replaces the jittery pointer of a few years back. Another is a windshield wiper blade of a type that eluded industrial research experts for years. In addition to their use on millions of motor vehicles, these wiper blades, developed after years of disheartening experimentation, now are used on windshields and bombardiers' windows of American-built aircraft.

In debt to creditors in 1932, this firm was forced to go into Federal receivership to weather the depression storm. Able to continue operating under this set-up, the company soon regained a solid footing and within a few years had paid off every bill, one hundred cents to the dollar, plus interest. Today this firm has expanded its facilities to include more than 40,000 feet of floor space and 250 employes. Due to heavy war demands, its volume of work has increased more than 60 per cent over its peak peacetime year.

With intensive research programs being conducted to improve America's weapons, the products of the automotive parts industry are being steadily improved—a factor that points the way to important advances in post-war transportation.

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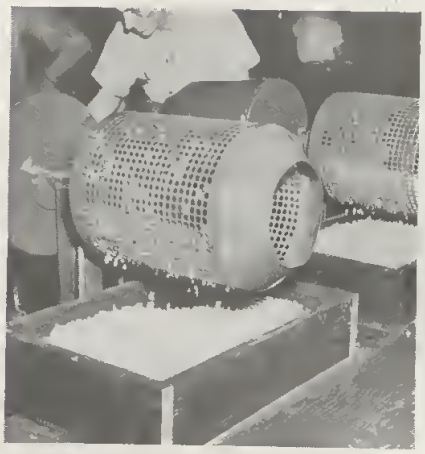


Useful Rivets Saved By New Sorting Device

Motor Plant Conserves Many Scarce Metals

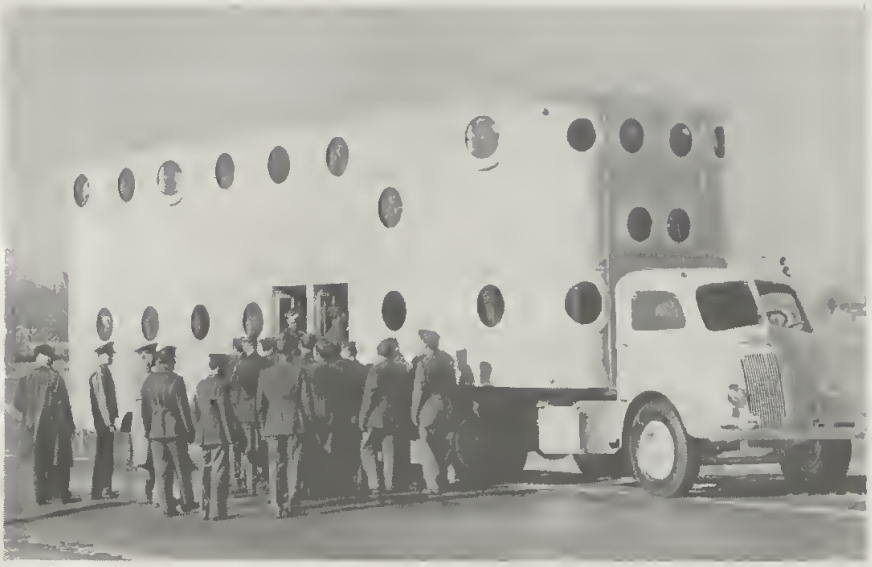
WITH materials and manpower the only limits on war production, technical experts in the automotive industry are diligently searching for ways and means of overcoming these two problems.

Recently developed by one company is an unique rivet sorting machine which daily is saving hundreds of thousands of vital aircraft rivets, made of such critical materials as aluminum, copper and steel.

In mass producing fuselage sections of a medium bomber (250,000 rivets required for each) the automotive firm is using millions of rivets of different types and sizes every few days. Being small and light, rivets frequently are dropped or are otherwise lost when placed in position by hand. While nearly all can be retrieved, the job of sorting the 40 odd types of reclaimed rivets is tedious.

Therefore, the new sorting machine is a real boon. It is, in reality, a battery of four machines, each equipped with a revolving cylinder of different size perforations, so that the rivets which fall through from each of the four cylinders are grouped according to thickness. They are then dropped into a hopper with a revolving selector that sorts the rivets according to head type. The final operation is sorting according to one of 220 different lengths.

Formerly a costly operation, the task has been converted to a standard, economical practice and over 200 pounds of rivets per day are sorted.



Automotive Company Builds Giant Bus With Ample Capacity for 250 Soldiers

OLD-FASHIONED "Yankee" ingenuity —a part of America's heritage— is again on the rise in the nation today.

As a case example, look at the number of makeshift vehicles that have been built recently to relieve the nation's critical transportation problem. While most of these are specifically for the purpose of taking war workers to their jobs, one (shown above) has been built by a truck manufacturer to carry troops within the wide expanses of army camps.

Containing 700 square feet of floor space, the bus will carry from 250 to 260 men, with approximately 100 seated and the rest standing. It offers unusual load carrying efficiency in that the bus weight is only about 104 pounds per passenger as compared with about 414 pounds per passenger in a conventional-type bus.

With porthole-type windows for both lower and upper decks, the vehicle looks much like some fantastic land battleship. Although comparatively high (15 feet) its height is not especially noticeable due to the body width which is two feet greater than normal.

In the interior, benchlike seats on the first deck are located on the sides, with 4-foot aisle intervening. Upstairs, the seats are located on a center platform with 3-foot aisles on either side. This arrangement permitted higher ceilings for those standing.

This unit is unique in that it was built at a minimum of cost and with a minimum use of critical materials. The huge body, seated on a rebuilt transport chassis, is constructed entirely of wood with the exception of bolts, nuts, and braces. Instead of new tires, 14 used tires were employed.

Now carrying workers to war-busy automotive plants are many of the old haulaway trucks, used in peacetime to haul new automobiles to distant places. In these, the steel superstructure, which formerly supported the top row of cars, is stripped off, and a new body constructed of available materials replaces it. There is seating capacity for 47 persons, with sufficient standing room for more than 50 others.

Eight of the tractor-trailer combinations are already in service and the bus operating company reports that it is carrying more than three times as many passengers as a year ago.

The smaller type trailers that formerly carried only two automobiles have also been converted into passenger vehicles to relieve the transportation crisis in one midwestern city. Hauled by regular city buses, they can accommodate more than 30 persons.

Among other resourceful adaptations seen in various parts of the country is the regular automobile sedan which is sliced in half and a section added in the middle. This enables 15 passengers to be carried. Another is the house trailer, cleared of its usual interior and equipped with longitudinal seats which accommodate 20 persons.

Soldiers Build Tanks By Hand Methods

Part of Training Course In Tank Maintenance

"MADE BY HAND in the USA." This label could well be put on some of the "General Sherman" tanks that are being turned out at a large arsenal, operated by an automotive company.

No, the automotive industry hasn't forsaken the methods of mass production. Rather the hand assembly of these rolling fortresses is part of a training course conducted by the automotive firm to teach soldiers the proper techniques of maintaining tanks on the field of battle.

From parts and assemblies furnished by the automotive company, the trainees are completely assembling the huge M-4 tanks with hand tools. There are no cranes, electric drills or other power equipment, the only help they receive is from an 11-ton chain lift, which is equivalent to what would be provided by truck in the field.

Several tanks have already been completed. In assembling the first one, twelve soldiers under the supervision of a company instructor took just eight days to complete the job.

More than 200 men are now attending the school and are divided into four groups, covering engine, chassis, turret and assembly. Courses last from two to four weeks, with some men taking additional instruction up to eight weeks.

This is just one of many similar schools that are being conducted by the automotive industry to insure that its war products are kept in first-class condition at all times. Thousands of men have already passed through these factory classrooms and, in addition, trained instructors have been sent to Army camps all over the country and to overseas bases.

The value of this part of the motor industry's wartime job is emphasized by the recent statement of a high Army official that "one tank or truck in good condition over there is worth 100 rolling off assembly lines here."

It is a part of the wartime job for which peacetime practices were preparation; for, though mass production of motor vehicles was perhaps the most dramatic aspect, the automotive industry's functions embraced manufacture, marketing and maintenance.

Automotive Industry Adds Aerial Torpedoes To Expanding List of Wartime Products

WHEN the U. S. Submarine *Wahoo* returned to a Pacific Fleet base recently, it flaunted a well-used broom, symbol of the naval clean-sweep since the 17th Century, when Dutch Admiral Martin Tromp hoisted a broom to the masthead of his flagship to signify that he had swept the British from the seas.

The *Wahoo* on its latest foray against the Japanese in the Solomons had sunk a destroyer, a freighter, a troop-jammed transport, a tanker and, with its last torpedo, another freighter. Homeward bound, it had to let another Jap convoy pass unharmed because it had no more torpedoes. Said Lieut. Commander Dudley W. Morton, the *Wahoo's* skipper:

"When you have no torpedoes you sure feel naked."

To guarantee an ample supply of torpedoes, the manufacturing facilities of the automotive industry are now being employed. From at least two automotive companies—one, a former source of passenger cars; another, a supplier of motorized farm tools—the Navy is now being supplied with aircraft torpedoes of the type which played a major part in the U. S. victory at Midway.

Though descriptions of the torpedoes and manufacturing techniques are guarded secrets, the Navy has authorized some general information.

In many ways, manufacture of aerial torpedoes is one of the most challenging war production jobs undertaken by automotive masters of mass production. For torpedoes are totally unlike anything that has ever come down the assembly lines of motor vehicle factories. True, some automotive workers have handled peacetime jobs calling for equal precision, notably in manufacturing Diesel engine injectors; but perhaps no producer of motor vehicles had ever been called upon to build a complete product in which the tolerances were as close throughout as they are in torpedoes. Certainly few products have ever been mass-produced with such exact precision requirements.

In its manufacturing program, the former passenger car company relies upon 136 sub-contractors for the machining and sub-assembling of more than 5,000 component parts which, with more than 100 parts fabricated in its own departments, its workers assemble into the finished product.

It is estimated that, in the production of parts for one torpedo, workers perform about 20,000 separate operations.

Some of the most difficult of these operations are in the assembly of small parts. These are often performed under magnifying glasses. For these tasks, the automotive companies had to hire former watchmakers—people with patience, precision and skill, who developed the techniques and trained other workers.

Some of the parts must be accurate within a limit of 25 millionths of an inch. Others are so small that they can be lost under a fingernail, yet must be machined to exact dimensions.

For such painstaking work it is natural, therefore, that many of these meticulous tasks should gravitate to the capable hands of women. In the shops of the former farm implement manufacturer, special training was organized for women. Many of them rose rapidly to supervisory positions as group leaders, teachers and inspectors. Others have taken over such "masculine" tasks as tool grinding, machine set-up, layout inspection, the operation of internal grinders, and drafting. One battery of precision lathes is "manned" by a group including a former milliner, a waitress, a private secretary, a punch press operator and a financial reporter.

Developed originally in 1866 by a Scotch engineer named Robert Whitehead, acting upon a suggestion by an Austrian naval captain, the self-propelled torpedo has been much improved but its basic principles remain unchanged.

Between the beginning and the end of World War I, the size of the torpedo increased from 14 to 18 and then to the 21-inch diameter mostly used today. Length increased from 10 to 24 feet. Weight increased to a ton. Speed rose to 50 knots, and range increased to about 7½ miles, though the longest hit on record is 3,000 yards, made by a German submarine in 1917 on the U. S. destroyer *Jacob Jones*.

The modern torpedo has an arming gear at the tip of its high-explosive warhead which explodes on impact. Behind the warhead is a compartment containing a thin-walled flask of air held under pressure of 3,000 pounds per square inch. A water-filled balance chamber, the depth-setting and rudder control mechanisms, the turbine with its pre-heater, and the gyroscope for the control of steering occupy the aft compartment just ahead of the drive shaft and gear box. There is even a built-in device to sink the "tin fish" in the event of a miss, so that it will not become a drifting menace.

Launched by destroyers, submarines and torpedo boats, torpedoes have been among the most destructive naval weapons. Launched by torpedo planes, they become the deadliest of all marine missiles.

AUTOMOTIVE
WAR PRODUCTION

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Plants Help Employes Meet Wartime Conditions

Automotive Experts Combating War-Created Personnel Problems

PLANNING and scheduling, those principles of sound management which the automotive industry so successfully employed in peacetime, are now being used to avert or minimize problems of war production which arise from the nation's increasing needs for all available manpower.

To enable workers and their families to effect their private conversion from peacetime to wartime conditions, the industry's managers are today applying to problems of manpower the same kind of planning and scheduling which, applied to methods, machines and materials, wrought wonders in the conversion to war production a year ago.

Through a new manpower division of the Automotive Council, 550 companies in the automotive industry are pooling information. Working cooperatively, industry specialists are compiling data on the availability of women workers, part-time workers and employment of handicapped persons. Other groups are delving into incentive plans, studying training and upgrading methods, comparing notes on initial supervision practices and recreational facilities. Health, safety and nutrition programs fall into one working committee, while another tackles Selective Service problems and still another such labor mobility factors as transfers, transportation and housing.

Individually, many of the automotive companies have embarked upon activities designed to keep production at high levels despite such disturbing factors as increasing losses of trained personnel to the armed forces, mounting demands upon training facilities by larger numbers of unskilled workers, increasing numbers of women workers in plants originally designed for men only, and shortages of shelter, food and transportation.

As total war is a total disturbance of *all* human life, the individual human's conversion to the unfamiliar and unwelcome conditions is mainly a matter of morale. Therefore, many of the company programs are designed to go right to the heart of the problem. The relation of nutrition to morale, for example, presents one of the broad fields now being explored by the industry's personnel managers.

Man must eat. From this irrefutable premise the planning and scheduling of many of the industry's managers proceed. Hence, many companies are encouraging and aiding workers to grow some of their own food, both for the healthful recreation involved in the effort and for the nutritional reward.

One automotive firm, located in Pennsylvania, recently leased a 100-acre farm which it will operate itself to provide vegetables to its 650 employes at cost. If men with farming experience can be hired, they will work the land at the same pay-rate as factory workers. If such labor is not available, the farm will be operated by plant employes.

Another automotive firm, in the midwest, has leased 26 acres near its plants. This tract, measured off into 20 by 40 foot gardens, is being turned over to the workers. To get its employes started right, the company obtained soil analyses of the gardens, hired a skilled farmer to give advice, set up a model garden, and provided convenient tool storage.

Although victory gardening is a new project, a number of automotive companies have a background of experience that is now proving valuable. Thrift gardens were fairly common company and community activities during the depression years, and at least one large firm has been aiding its workers in gardening for many years.

This company's program, launched originally during the

(Continued on Page 7)

Automotive Officials, Technicians Observe Battle Performance of War Products

Automotive executives accompany tonk battolians an desert maneuvers.

IN ARMY camps and naval bases, in the United States as well as overseas, scores of civilian technicians, including members of top management of automotive companies, are today assembling first-hand information about the performance of their companies' products under the conditions of actual combat.

For the purpose of improving American weapons, these representatives of management, some of whom were under fire at the fighting fronts even before Pearl Harbor, share all the hardships and risks of the armed forces. Scores of them are today stationed in England, North Africa, the Middle East, India, China, Australia and on every other front where automotive equipment is in action.

Typical of the hazards that such men face are the experiences of the service engineers of one company. Formerly a manufacturer of automobiles, this company now maintains a field force of more than 60 engineers who have been trained to service its products wherever they may be in use.

The other day one of these men came home to collect his accumulated salary checks, cash his expense accounts, and replenish his wardrobe. The latter was the more important of his three reasons for coming home, he said; for, one night during the recent sweep of the British Eighth Army across North Africa, German planes dropped a total of 90 bombs within radius of a mile of the tent in which he was sleeping near Sirte, Libya, and his duffel bag and contents, which he had placed under his cot, were riddled with shrapnel. As a memento of his narrow escape, he recovered his service manuals which had been punctured and charred by hot bomb fragments.

It was this man's job to supervise the service and maintenance of his company's engines in American and British planes operating with General Montgomery's Army. During that period last year when Allied air power alone stopped the victorious Nazis in their drive into Egypt, he and his associates worked day and night without rest, repairing battle-damaged planes in a series of huge caves which, excavated by the quarrying crews who supplied limestone blocks for the Pyramids thousands of years ago, had been converted into repair and supply bases for the equipment of modern war.

Flying from Alexandria to Detroit in less than a week, with several stops en route, he remained at the factory only long enough to fit himself for another trip to "parts unknown."

Recently, too, the service chief of this company's marine engine division flew to England to inspect repair facilities at English Channel and North Sea bases. Flying at high altitudes in a bomber loaded with supplies, he endured the discomfort of extreme cold in crowded quarters all across the Atlantic. In England, he underwent the ordeal of several bombing raids while helping his company's service engineers repair the power plants of naval craft that had been battered by shellfire.

As early as April, 1941, another automotive firm had two men with the American Volunteer Group in China. Four months later, this company had 19 civilian observers and service engineers with the Allies in four theaters of war. Today, more than 50 of its technicians accompany the fighting forces in Iceland, Greenland. South America, Europe and the Far East.

In the managerial ranks of the industry there are many veterans of the first world war who are today leaving busy desks to observe in action the modern weapons being manufactured in automotive plants.

Recently the president of one large company, accompanied by members of his executive staff, spent four days with the armored forces in a California desert. They rode in tanks in which the temperatures rose as high as 140 degrees F. They lived with the crews, sharing their rations and sleeping under the stars. And, from the fighting men who know what it means to be stranded in the desert by a major breakdown of motorized euipment, they learned the importance of quality workmanship on the factory front.

Another automotive executive, charged with the responsibility of supplying replacement parts for all war material produced by his firm, participated in Army maneuvers in mountainous terrain and thus obtained a soldier's understanding of the terrific punishment that automotive equipment must sustain without failure. He returned to his desk with considerably heightened respect for American military management, having observed at close range the huge problems of servicing and supplying troops and their mechanized equipment in the field. For example, he recalls, the vehicles of the battalion which he accompanied consumed one thousand gallons of fuel every hour, but it was always on hand when needed.

Because much of the work which these representatives of management do in the field is shrouded in the secrecy of wise military censorship, the full story of these activities will not be revealed until the history of this war can be safely written.

Large Portion of Automotive War Job Is Shared by Capable Subcontractors

Nationwide suppliers ship parts to motor plants by air, rail and highway.

FOR SUCH difficult jobs as threshing and corn husking, American farmers cooperate with their neighbors, thereby accomplishing in a few days tasks which, undertaken individually, would require weeks or even months.

The automotive industry's method of spreading out its war job all over the nation is in many ways similar to this group system of farming. For, by taking advantage of existing plants, equipment and workers of thousands of sub-contractors and suppliers, it has been able to reach seemingly impossible levels in the production of war materials.

Though subcontracting is by no means a new practice in the automotive industry, it has been greatly intensified since Pearl Harbor. Today widely scattered firms feed millions of dollars worth of parts and materials into automotive plants each month.

For instance in producing jeeps for the Army and the Marines, one automotive firm is relying on subcontractors for 91 per cent of the jeep parts. On virtually all of its war work, this company has allocated five out of every six dollars in contracts to other concerns in 106 cities, located in 22 states.

One comparatively small automotive manufacturer delivered more than $6,000,000 worth of war materials in a recent three months' period. Of this total more than 50 per cent was paid out to 199 subcontractors. These firms varied in size, with 62 employing less than 100 workers each, 78 ranging from 100 to 500 employes, and the remaining 59 with more than 500.

Still another automotive firm recently reported that even in peacetime its business embraced more than 10,000 other companies, the majority being small businesses. With war production underway in 1942, it added nearly 1,000 new firms to its list of suppliers. A still further increase is expected in 1943. These companies furnish raw materials, supplies, finished and semi-finished parts, as well as services of all kinds.

To get many of its war jobs underway, the automotive industry has turned to concerns completely "foreign" to methods of mass production. In several instances, surprising results were obtained.

For machining operations on gun stocks, one automotive company placed an order with a chair manufacturer whose woodworking facilities were available. The furniture company had hardly started on the job when it notified the automotive firm that one of its highly-skilled workers had greatly reduced time requirements by designing a special-type machine. Therefore, it was possible to greatly increase deliveries of the gun stocks.

Not only did this help the prime contractor, but in addition it proved so successful that the machine is being copied by Army Ordnance for use in other gun plants.

On this same job, a one man subcontractor—a disabled man—is utilizing his skill and experience in a home workshop where he reworks gun parts that have failed to pass inspections.

Comprising 800 companies, located in 30 states and 150 cities, the automotive parts industry is the largest group of subcontractors to the industry.

Sales in 1942, composed almost entirely of war material, totaled close to three billion dollars, as against $1,800,000,000 in 1941, record peacetime year for the parts industry. And, it had 400,000 workers on its payrolls compared with a peak of 250,000 in 1941.

Vast War Deliveries Made by Motor Trucks

IN THE battle for more production of arms, highway transportation is making an important contribution, as witnessed by the huge amount of war goods—raw materials, fabricated and semi-fabricated parts, and finished products—being hauled by motor trucks.

A recent survey of 227 truck operators, for example, showed that of the 30,469 loads carried in one week's period, nearly 75 per cent contained military materials or products. In another survey of 741 war plants, 65 per cent of incoming freight and 69 per cent of outgoing freight was being shipped by truck. Likewise, the amount of shipping, both incoming and outgoing, carried by motor vehicles averaged better than 50 per cent for 1,311 small firms in Minnesota, Missouri and South Dakota.

Despite being hard pressed by the urgent demands of the war effort, trucks are also doing a herculean job in the maintenance of the essential civilian economy.

According to a tabulation of *The Corn Belt Farm Dailies*, motor trucks delivered more than 60 per cent of the cattle, hog and sheep tonnage that was hauled from farms to market in 1942. A total of 9,250,850 tons of meat animals were marketed by truck and the average distance for each trip was estimated at 125 miles.

HOW IT'S DONE

No. 3 Production Flow

In wartime, as in peacetime, efficient mass production depends on precise coordinated flow of materials.

SINCE THE beginning of the war sixteen months ago the automotive industry has steadily pushed its war production above peacetime levels Currently it is delivering war goods at a rate 45 per cent in excess of any previous peak

With many other industries also stepping up their output a situation has been created in America unlike anything ever experienced before—production capacity exceeding the supply of raw materials

Therefore to utilize the materials in the most effective manner, they must be geared to the urgent needs of the armed forces of the United Nations Today as President Roosevelt has said the demand is for bomber and pursuit planes and ships of many types Tomorrow depending upon the shifting tides of battle it may be something totally different that is placed on the list of most essential weapons of the moment

To regulate the supply of critical materials so that the efforts on the production front correspond with the needs of the battle fronts, a national materials distribution program is now underway Called the Controlled Materials Plan it is designed to provide balanced production so that every ton of material is processed into those weapons needed most

It replaces, for the duration, that system of each company buying its materials in the open market The United States government, through the War Production Board, is assigning critical materials to manufacturing plants under a program designed to take care of both war production and civilian output

During peacetime, the automotive industry was able to achieve mass production through a balanced, planned and controlled flow of materials

This flow started out of necessity more than three decades ago when, operating on a shoestring basis because of a limited amount of capital, most companies couldn't afford to maintain stockpiles of parts and materials

To meet the obligations of the firms who were supplying the materials, it was necessary to keep elapsed time between incoming supplies and outgoing finished products at the very minimum thereby transforming raw materials and components into cash as rapidly as possible

Into the manufacture of an automobile went about a ton and a half of iron and steel, some copper, brass and lead numerous pounds of lacquer, a few square yards of glass, some wood, plastics and textiles a multitude of rubber parts and hundreds of other raw materials

With thousands of cars being turned out daily, there were hundreds of thousands of tons of materials in various stages of processing at all times And, though some of the fabrication of raw materials into components was done in the large plants the majority came from hundreds of small parts companies all over the nation

Despite the complex problems presented in the huge total of materials and the many suppliers, the assembly of the completed automobile was accomplished in a beautifully coordinated flow Production experts of the plants carefully planned their schedules, then carried them out exactly as planned. They knew when the raw materials would arrive in the plant when the components would arrive On assembly into the end product, every subassembly and every part, from crankshafts to stone guards for fenders, arrived at the proper station at the time when the assembly worker needed it.

To accomplish this balanced flow, it was not necessary for the automotive industry to operate with large inventories of parts and materials on hand In fact it could not, first of all because of the thousands of parts in a car most plants could not accommodate the huge stockpiles that would have been needed Secondly a close control of inventories was necessary to avoid serious financial loss at the end of a model run or if a design change would suddenly obsolete parts

An example of the mass production scheduling of peacetime is the case of an Akron manufacturer who, making a number of small automobile parts kept his output just a day and a half ahead of one Detroit plant's parts bank reserve Motor trucks rolling up to the shipping platform throughout the day and night, provided the link from the manufacturing plant to the assembly plant, 180 miles away.

According to specialists in the automotive industry, the new materials plan contains the necessary elements to effect an orderly control of materials and at the same time to accomplish war production operations geared to the changing demands of the fighting forces

Recently, industry has been working with the government to find ways to simplify methods of controlling the flow of materials so that the mass of reports involved does not increase the difficulties of distributing materials

However, it has been stressed this does not mean that operating difficulties will not arise As Donald M Nelson, chief of WPB said recently in pointing out the tremendous problems of adjusting the flow of materials to the productive capacity of all the allied nations, this economy is like a great big balloon You punch it in here, and it sticks out somewhere else It is going to bulge whenever you interfere with the free flow of the competitive system of materials and that is what we have had to do in order that they may be directed into the things in the order of their urgency to the war and to the maintenance of the civilian economy"

Nor does it mean that changes in the military strategy of the United Nations will not upset schedules Plants that today are working 'round the clock striving for the utmost production of, say, attack bombers, may be slowed down considerably tomorrow, in order that neighboring plants may get first call on materials and thereby rush more critically needed pursuit planes to North Africa for the launching of an offensive

Under such conditions it is anticipated that workers will undoubtedly lose a day's employment occasionally Or, they may be forced to stand by for a couple of hours some days with nothing to do, while waiting for materials to come into the plant While such slowdowns and stoppages are left unexplained for military reasons, the unpredictable events of today's war are dictating strategy, not only to the battlefront, but to the production front as well

John Hersey aptly stated the situation in his book, *Into the Valley* 'War ... seems to be nine-tenths waiting—waiting in line for chow waiting for promotion, waiting for mail for an air raid, for dawn, for reinforcements, for orders, for the men in front to move for relief for that runner"

On the home front bottlenecks frequently occur, making it necessary for both management and plant personnel to wait for arrival of necessary materials

The Controlled Materials Plan is not expected to be infallible, largely due to the tremendous size of the job Significant, however, is the fact that its basic principles are closely patterned to the mass production system, developed and proved by the automotive industry after 40 years of building passenger cars and trucks

Materials handling system of the automotive industry—developed, tested and proved in more than 40 years of successful manufacture of passenger automobiles and commercial vehicles—is now being adapted to the assembly lines of America's war production plants.

"We have always worked with the automotive industry as one of the leaders, because the automotive industry has had more experience with control of material flow than any one group of manufacturers in the United States." . . .

Donald M. Nelson, Chairman, War Production Board

Wartime Teamwork in Automotive Plants Results in Development of Amphibian Jeep

ONE OF THE brilliant chapters of World War II has been the spirit of American industry to lay aside its competitive habits of peacetime and work cooperatively in the interest of greater production of arms.

This has been particularly true in the automotive industry. For over a year, former competitors have been sharing trade secrets, going into each other's plants, solving problems in a spirit of mutual aid.

While the results are mirrored in the present high rate of production in automotive plants, a new twist to this wartime cooperation recently came to light when one company announced the development of an amphibian jeep. The unselfishness of another firm contributed much to this new product.

A few months before Pearl Harbor, during the defense program, these two companies were competing for an order for light reconnaissance cars for the Army. Both submitted models and, after exhaustive tests, one company received approval and began production of the now extremely popular jeeps. It wasn't long before the Army's requirements for these vehicles increased so heavily that, to meet this demand and to utilize the facilities of the other company, as well as its own, it turned over to the competitor all engineering plans—designs and blueprints—of the vehicle. With these plans as basis, the second company developed the new unit which operates as a truck on land or in the water as a boat.

The amphibian jeep's ability to propel itself in water is made possible by a device which automatically seals off the motor from water penetration when waves or rough water are breaking over the boat. On land it can perform every task ordinarily done by a quarter-ton four-wheel unit designed for land operations only. It has a carrying capacity of five men.

If necessary the unit can "pull itself up" a river or lake shore bank that would be difficult for a man to climb. This operation is accomplished by means of a power-driven winch in the prow of the boat. Any object on shore, such as a tree or a post, to which a rope can be attached, is sufficient to pull the amphibian car ashore.

The controls of the new Army transportation unit, for land operation, are identical to those of the regular jeep. No steering changeover is required from land to water operation.

After exhaustive tests by experts of the automotive company and those of the Ordnance Department, this product of American teamwork was approved and rushed into production. Many are already being used by U. S. fighting forces in war zones.

DO YOU KNOW?

More than a million and a half horsepower in Diesel engines is being supplied by an automotive company to the U. S. Navy for its recently announced Destroyer Escort program.

* * *

"La Cucuracha" is a song which has been a favorite among the soldiers of Mexico for many years. One of those impudent ditties which military men prefer above all others, its many verses deal with the exploits of its hero, a cockroach.

It was therefore a tribute of the highest order when Mexico's fighting men, introduced to that motor vehicle which men of the United States armed forces lovingly call the jeep, unanimously dubbed it "La Cucuracha."

* * *

Long before Germany and Japan revealed themselves as Axis partners, the strength to resist their depredations was being nurtured in the automotive industry of the United States.

Between 1922 and 1930 several hundred young Chinese were trained by one company for the huge task of industrial management which they handled so well when Japanese raids made it necessary for them to transport all of China's industrial plants into the interior.

As early as 1929 the Soviet government, too, began to draw upon the managerial "know-how" of the U. S. automotive industry for both construction and management of industrial plants whose output astounded even the Germans in 1941 and 1942.

AUTOMOTIVE WAR PRODUCTION

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for War Production

HARRY A. WILLIAMS, Editor

New Center Building, Detroit, Michigan

Ability to Handle Many Difficult Tasks Makes Trucks Valued Asset to Nation

With major league baseball clubs hard hit by the armed forces' drain on the supply of manpower, it is not uncommon during the current spring training drills to find managers familiarizing their available players with other than their regular positions. Thus, if a team suddenly found itself short-handed, an outfielder would perhaps be able to fill in at first base or behind the plate.

While this practice is a wartime necessity in the baseball world, such a utility role is far from unusual for motor trucks. The ability to handle any job, in a pinch or otherwise, is commonly expected of commercial vehicles in peacetime as well as wartime.

Take, for example, the truck-trailer combination that is hauling huge deckhouses for Navy PC sub-chasers from the plant where they are built to a shipbuilding yard where they are attached to hulls.

Previously, these deckhouses, too big for railroads to handle, were floated by scow to their destination. When winter set in, freezing the lakes and rivers, the job was turned over to a hauling concern with some large trucks.

The sub-chaser cabin is over 40 feet long and 24 feet wide at the widest point. It is built on a steel frame or jig which is bolted to the trailer and, when it reaches the shipbuilding firm, it is removed and set on the deck of the boat through the use of two yokes equipped with slings. Two large railroad cranes effect the transfer.

Due to the length of the unit, it was necessary to add a 20-foot extension on the rear of the trailer. And, because of its extreme height, a man must ride on the top deck in order to clear the low traffic wires and street lights that are encountered. With the cooperation of local police authorities and the state highway department, this has not proved a stumbling block. However, it does restrict the hauling job to daylight hours only.

Though officials of the firm building the cabins and those building the complete sub-chasers were at first dubious as to the ability of trucks to handle the job efficiently, deliveries have been made on regular schedule. As a matter of fact, the hauling concern, despite a severe winter with more snow than usual, is 10 days ahead of schedule at the present time.

Citing the value of motor trucks and their contribution to the nation's war effort, Joseph B. Eastman, director of the Office of Defense Transportation, recently stated: "Automotive transportation is absolutely essential to the winning of the war. Goods must reach their destination and workers must get to their jobs . . . on time."

Plants Help Employees

(Continued from Page 1)

first world war, has never been discontinued. As long ago as 1920 its workers cultivated 900 gardens on company property. This year the program has been intensified.

Many company publications are fostering the effort by offering rewards for the best kept and most productive gardens, and by publishing authoritative advice.

In other directions, too, the management of the industry is exploring new fields for improving the morale of workers. The influx of white collar workers and housewives into factories presents many challenges to the ingenuity of personnel directors.

In one plant, for instance, a woman with 30 years of experience as a social worker has been hired to aid women to adapt themselves to factory conditions.

An automotive supply company has augmented its working force by the addition of part-time workers who, drawn from the so-called white-collar groups, come to the plant for split-shift work after their regular day's work is done. This has added the equivalent of 1,000 full-time workers to the staff, but it has also faced management with new problems in industrial relations.

As an example of such problems, one company is planning to establish a separate employment office to facilitate the hiring of professional and semi-professional workers.

Overtaxed transportation facilities have posed new problems for personnel managers, as have shortages of living quarters, and the impact of wartime rationing regulations.

Such problems are being met variously by automotive companies. Some have developed effective share-the-ride programs. Some have set up housing information services. Others are exploring ways to supply day nurseries for the children of working mothers.

Automotive Workers Boost Weekly Wages 58 Per Cent

Due to an increased work week in automotive plants, the average earnings of automotive workers have far exceeded increases in cost of living.

From January 1, 1941, to January 1, 1943, according to a survey of the National Industrial Conference Board, the average pay check of automotive personnel had increased nearly 58 per cent. During the same period, the cost of living advanced 18 per cent, the NICB reports.

PEACETIME RESEARCH ADAPTED TO WAR OUTPUT

Automotive Method of X-Raying Penetrates Thick Tank Armor

AS MEANS to achieve an end, war is without doubt the most wasteful of all human habits. Yet, as history amply proves, it does expand man's horizons, accelerate the rate of discovery and stimulate invention. Without exception, every conflict of the past 200 years has fostered discoveries which, though motivated by the strong desires for efficient mass-destruction which drive humans in wartime, have implemented the equally strong desires for efficient mass-production which drive humans in peacetime.

Very often, new devices, or improvements of old devices, though designed for the extinction of human life, subsequently become tools for the expansion of human life. Take, for example, the powerful X-ray equipment with which a number of automotive companies are today conducting routine inspections of weapons on an assembly-line basis but which will certainly contribute to better living when this war is over.

In their adoption of X-ray as an inspection instrument, the automotive industry's metallurgists are employing a tool which is the earliest and most familiar development in what is now known as the science of electronics. Discovered in 1895 by the German physicist Wilhelm Konrad Roentgen, X-rays gave man new eyes with which to see through things. A laboratory curiosity at first, they soon invaded the field of medicine, and then branched out into many industrial ramifications, such as radio telegraphy and telephony, sound recording and amplifications, television, etc. Put to inspection jobs in factories, X-ray reveals hidden flaws and foreign substances in materials which, without its use, would not be detected or would require destruction of the material by inspectors.

It is this latter phase of X-ray's industrial function which has become of particular importance under the drive of wartime necessity. For testing to destruction, the method most often employed to discover structural flaw, is wasteful of both time and material. Hence, substitution of this penetrating electronic eye for the customary inspection-by-destruction processes not only speeds up productive operations but conserves materials.

Million-volt X-roy mochine tests welds on M-4 tanks.

Just as World War I gave man a time-saving tool by introducing the welding torch into industry, World War II is adding refinements to that tool by introducing X-ray as a positive method of inspecting welds.

The need for an inspection device that could test welded armor plate without destroying it arose when the automotive industry began production of tanks with welded hulls.

The industry's metallurgists offered the X-ray apparatus that had been standard equipment in all automotive laboratories. But, although such laboratory equipment could penetrate five inches of metal, it took several hours to complete the inspection and was therefore limited to the testing of occasional samples. What was needed was high-powered X-ray equipment, fast enough to enable operators to inspect parts on a mass production scale.

The answer to this need was the development of million-volt X-ray super-inspectors. Although such multi-volt tools had been previously built for use in hospitals for cancer treatment, they were enormous in bulk. To adapt these hospital giants for factory use, the bulk was reduced to one-third by the development of a new method of insulating the machine. Freon gas, perfected in an automotive industry laboratory as a safe refrigerant for household refrigerators a number of years ago, was adapted in place of the oil formerly used.

Compressible into a smaller space than oil, this gas not only enabled a reduction of bulk in equipment, but proved more effective than oil as protection against the high voltage employed. Because million-volt rays are powerful enough to be injurious to anyone subjected to their impact, the room in which the equipment is housed requires special protection. The room for one automotive company's X-ray inspection line has walls of concrete 18 inches thick.

As a result of the development of X-ray machines capable of penetrating armor plate eight inches thick, electronic researchers have recently perfected an induction electronic accelerator said to be capable of hurling electrons about 800 miles.

Such war-induced invention is incubating thousands of new tools for the post-war world behind the veil of wartime secrecy. Not until the veil is lifted will the benefits be revealed.

AUTOMOTIVE

WAR PRODUCTION

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Factory Schedules Reflect Shifting Strategy of War

"There are no constants in this war,"
Frank Knox, Secretary of the Navy.

MIDWAY in its second year as a department of the nation's arsenal, the automotive industry is experiencing a new set of production signals, calling for highly selective output of war goods.

The give-us-everything-you-can-make demand characterizing the first phase of the nation's war production effort now has given way to new scheduling procedures, which call for more of one item, less of another, depending on current strategical requirements.

For the lessons of combat, learned at the fighting fronts, are now reaching the production front and making themselves felt in countless contradictions and inconsistencies growing out of war's natural disorderliness.

Consider, for example, the inconsistency that baffled the workers and harassed the managers of a former automotive plant when the sudden shifting of war's demands recently caused a four-day shut-down of tank assembly lines followed shortly thereafter by a sudden need for overtime work on Sunday.

Or, for contradiction, take the case of the workers who, having visited an Army camp and found the military lacking equipment, returned to work to find that their plant had been forced to slacken its schedules for the particular equipment it was making for shipment abroad.

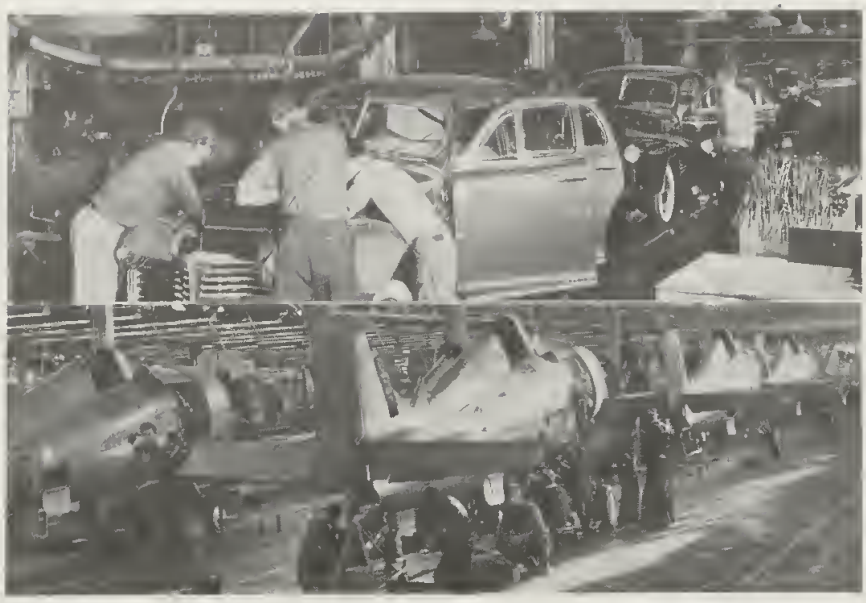
Inexplicable interruptions of work, compounded confusions of conflicting orders, unreasonable spells of idleness and boredom followed by equally unreasonable spurts of frantic action—all are unavoidable components of military life, and are accepted as such. As a result of the totality of modern war, they now have spread to the production front, where the reasons are seldom apparent. Sometimes the only clew is a fragmentary account of a battle action half a world away. Again, it may be a delay in getting steel from a mill in a neighboring community. But more often than not the real reason is shrouded in military secrecy. Hence, the effect is more likely to be a severe test of morale than of skill.

War is always capricious, cruel, and inconsiderate. As an example, consider the following by-product of a sudden schedule change:

Last Fall sports-loving workers in a midwestern city decided to forego their annual deer-hunting expedition in order to stick by their jobs of making shells.

Then, on the very day that the hunting season opened, production of shells at this plant was brought to a stand-

(Continued on Page 6)



From automobiles to warplanes in less than a year's time.

Coast-wise Car Assembly Plants, Once Idle, Now Producing Variety of War Materials

BEYOND the mountain ranges that hem in the broad Midwestern valley, automotive assembly plants—erected for highly specialized, single purpose jobs—are operating full blast for war.

Established in peacetime to quickly assemble finished cars and trucks for nearby metropolitan markets, these plants were little more than empty shells a few weeks after Pearl Harbor.

Today, the same structures are teeming with activity—alive with the production of completed airplanes, armored tanks, high velocity shells and other materials of war.

Where automobiles rolled off assembly lines in Linden, New Jersey, less than 15 months ago, today Wildcat fighter planes and Avenger torpedo bombers move down the reinforced concrete aisles in volume and take to the air.

Highly specialized, capable of producing 18,000 cars a month, this plant was converted from its one-job function to the seemingly impossible one of making airplanes, all in a span of 11 months. In the interim, its complex conveyor belts were tossed into the scrap heap, all but 77 pieces of its manufacturing equipment was trucked away.

Two other Eastern assembly plants and two parts factories teamed up with it to produce for the Navy these deadly rangers of the skies. Today, America's air power is being augmented daily by the men and management of this one-time empty shell of a plant.

Another former assembly plant today flicks out more .45-caliber cartridges in 24 hours than were made in a year in all of America's plants in peacetime, it was recently revealed. Approximately 10,000 rounds a minute are being produced under a newly-developed process calling for steel cartridges rather than brass. For every 100,000 cartridges produced, more than 1,700 pounds of brass is conserved for other war needs, the War Department reports.

At one of its Chester, Pennsylvania, assembly plants, one company is operating the largest tank-modification center in the United States. Thirty types of armored vehicles manufactured by 18 automotive companies are sent here for special equipment, depending upon the theatre of war they are destined for. Total shipments from the plant are more than 200 vehicles a day.

Still another assembly plant in Southgate, California, provides another source for powerful M-5 tanks, outfitted with major units supplied by the parent company in Detroit. A sizable part of this plant has been converted to actual manufacture, in addition to assembly operations.

Peacetime Technique Aids Aircraft Output

Automotive Method Cuts Use of Time, Materials

SPINNING at rates up to 3,000 r.p.m. in the automotive industry's foundries, whirligig molds filled with liquid steel at white heat are saving incalculable totals of precious hours in the production of warplanes and their engines.

The whirligig molds are part of the metal-working technique called centrifugal casting, or "liquid forging." Foundry technicians developed it for mass production of automobile, truck and tractor transmission gears, ring gears, pistons and brake drums at lower costs, increased speeds, and with reduced wastes of machined-off metal. The peacetime-developed technique has now been extended to aircraft engine parts.

On one radial type engine, the cylinder barrels were made of aluminum forgings until an automotive company took over manufacture of the engine. To ease the aluminum shortage, the automotive engineers experimented with steel cylinder barrels, centrifugally forged. The result was an engineering change which provided a superior product and introduced savings which are best demonstrated in comparisons of old and new barrels.

Against the 58-pound weight of the old forged barrel in the rough, the cast steel barrel enters the machining operations with a weight of only 37 pounds.

The elimination of 21 pounds of metal at the start means a considerable reduction of hours required for finishing the part, a large saving of manpower which can be diverted to other work, a conservation of hard-to-get machines and tools, and the elimination of all the transportation, handling and fabrication formerly required to re-circulate the excess metal back through furnaces, mills, forges and machines.

To fit such liquid forged steel barrels into their light-metal housings, engineers placed a refrigerator beside a furnace to take advantage of the opposite effects of heat and cold on metal. Before insertion of cylinder barrels, the housings are expanded in the furnace while the barrels are being contracted by exposure to dry ice. The result is a perfect fit.

Army Using Trucks In Life-Saving Role

New Types Designed to Aid Pilots, Crews

IN this war, the Army has come to rely on motor trucks for hundreds of vital jobs. Now comes a new vehicle —a super-crash truck—that is designed to carry out that Air Force command, "save the crew."

With this truck, designed by the Army and produced in quantity by an automotive company, the rescue squad moves right into the cockpit or cabin of a blazing airplane, laying down a screen of fog, and hauls the crew to safety. The squad then devotes its attention to the airplane, salvaging as much of it as possible by covering it with a blanket of chemical foam.

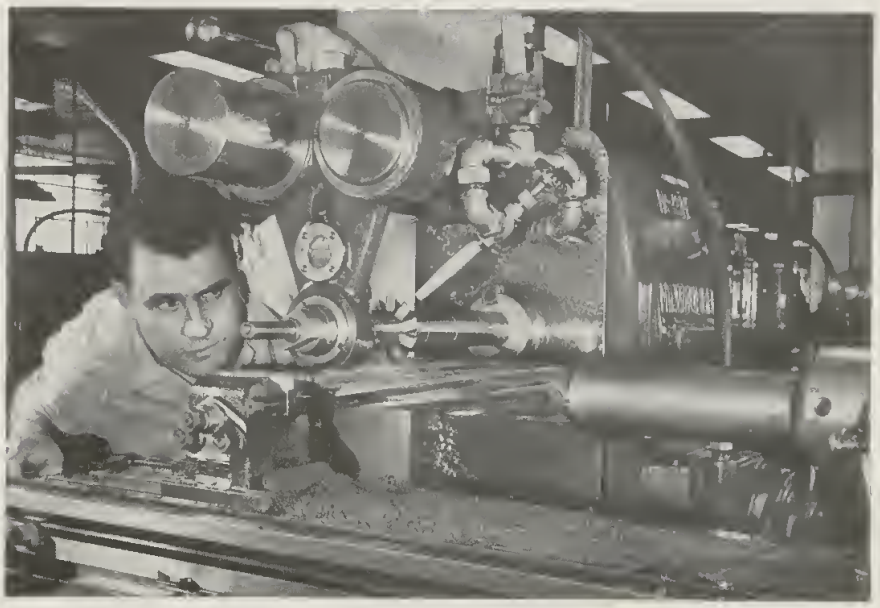
The truck is light, fast and powerful to meet the Army's specifications. It is capable of coming within a few feet of the blazing airplane, where its engine then cuts in on a powerful pump that exerts 600 pounds of pressure per square inch in delivering 50 to 60 gallons of water per minute. The truck carries 300 gallons of water and the customary hand fire extinguishers, crowbars, door openers and other rescue equipment.

To keep airfield runways free of debris or other obstructions that might hamper planes in take-offs or in landings, another vehicle, equipped with a giant crane, has been developed by the Army Air Forces. Its primary purpose is to remove planes that have been wrecked in take-off or landing operations.

Powered by a 200 hp. Diesel engine built into a tractor, the unit can travel to the scene of an accident at more than 18 miles per hour and quickly remove damaged planes from runways.

Automatically controlled, the huge crane is capable of hoisting 60,000 pounds 35 feet into the air from the rear wheels of the vehicle. Total weight of the crane and tractor is over 130,000 pounds.

The weight of modern bombers is such that heretofore it has not been an easy task to get them out of the way of other planes and into repair shops. With the new mobile cranes, the Army can now accomplish the job in a matter of minutes.



More than 750 types of cutting tools come from former automotive plant.

War Production Bottleneck Averted, As Ingenuity Is Applied to Cutting Tools

MACHINES plus tools are machine tools. Machine tools make mass production possible. Without bits, drills, reamers and similar accessories, the machine is like an automobile without a battery or tires—it can't function. Ways and means of overcoming shortages of cutting tools, which in recent months threatened to bottleneck the output of many vital war materials, provide another example of American ingenuity.

Several months ago, cutting tools were so much in demand that it took up to fifteen weeks to obtain them from suppliers. Such a delay threatened to hold up production of tanks, anti-aircraft guns, bombers, aircraft instruments, and many other war projects of the automotive industry. So a company that formerly produced automobile bodies decided to build cutting tools itself.

Although such manufacture is far removed from automotive building, the plant is turning out more than 750 different types and, since the inception of the program, more than 50,000 tools have been produced. Today the plant can turn out up to 500 a day.

Nearly all the tools are built on order to meet specific requirements, rather than on a mass production basis of standardized types. Weight ranges from ¼ of a pound to 100 pounds.

As the program has developed, the automotive company has come up with some startling developments in methods of manufacture.

For use in connection with tank ring and turret turning operations, for example, tool holders have been devised whereby the cutting unit consists of both a holder and the tool.

Now, when the tool breaks or becomes dull, a new one can be inserted in the holder, eliminating the replacement of the entire unit. For the tank job, alone, this idea resulted in a monthly saving of 30,000 pounds of critical steel.

A unique means of salvaging cutting tips—those extremely hard-to-get items made of high-grade carbide—has also been developed by this company. When the tip becomes worn or broken it is removed by an acid process, reworked and resharpened, then reinserted in the holder.

Interchangeability had long been fundamental in achieving mass production of automobiles. The same principle has been adopted by the former automotive body company to increase production of cutting tools. Arbors, or holders, are now being made on a volume basis with all cutters interchangeable. Heretofore, a cutting tool could only be used in the arbor that it was originally made for.

No. 4—How It's Done

THE PRIME CONTRACTOR

The moving spirit of war production—the staff that analyzes the job, organizes the work, forms it out, assumes responsibility for carrying it through to completion.

HOW DOES a war production job get organized and underway? How are highly specialized subcontracting facilities tied together, so each contributes to the finished war product?

In placing an order for tanks, or guns, or planes, first you look for a company with ability to organize the production job and break it down into components. Your prospect's qualifications call for knowledge of engineering and design, of materials flow, of research, of personnel of purchasing, of equipment requirements and many other bits of 'know-how"

Virtually all automotive and truck companies and many of the industry's major parts concerns are prime contractors in the nation's arms program. Nowhere in the world, perhaps, was there a greater accumulation of "know how' and experience than that developed in the automotive industry over a half century Under a system of free enterprise that fostered the growth of individual skill, the automotive industry—from the men of top management to the men of machines and assembly lines—was staffed with specialists, men developed in the hard school of experience

Though viewed as "big business," most automotive industry organizations break up into several small businesses. Each operating unit performs under a system of decentralized control, keyed to the common objectives by liaison from department heads to the directing management Policy is formulated at the top, but responsibility for operations rests at the departmental level

Let's consider a few functions of the prime contractor that distinguish him from other manufacturers

RESEARCH—One characteristic of the prime contractor is his penchant for research, evidenced by the fact that the automotive industry maintains or is affiliated with more than one-third of the nation's industrial research laboratories Brought into being years ago as an integral part of automotive development, research found solutions for hundreds of problems of war production. Technicians heve developed substitute materials to replace those sopped up by the demands of war From the minds of peace-loving research scientists have come improved weapons, and ideas for more deadly arms

ENGINEERING—Much credit for the swift conversion of automotive facilities to war production lies with the industry's experienced, versatile engineering staffs Working night and day, these men mapped out plans for new production set ups even before aisles were free of obsolete machines and conveyor lines left over from car manufacturing

Others pored over blueprints, organized the job, studied the best manufacturing process, worked on design, analyzed machine and tooling requirements, determined which parts to purchase and which to make, ordered the tons of needed raw materials

Though many of the war products then seemed as strange as the bazooka to the automotive industry, the change-over to new production was not a new problem—just a more extensive one For the same principles applied to this conversion as hed applied to the annual model changes of automobiles

PROCUREMENT—Facing the automotive companies was the big problem of where to locate efficient subcontractors and suppliers Fortunately, its long-pursued policy of spreading work widely now proved more useful than ever Not only were thousands of peacetime suppliers acquainted with the prime contractors' needs, but many more were obtained through lists compiled during industry's aircraft subcontracting exhibit, the first in America, which had been established in 1940

Automotive companies were thus able to get their job started while combing the nation for additional firms that could take on other "bits and pieces" of various war products

In dealing with as many as 8,000 firms, an automotive purchasing department hes to rely on experienced men from its staff—expediters—who work with subcontractors, help them procure raw materials, tools, equipment and supplies, and assist them in meeting production schedules They thereby assure a steady flow of subcontracted items to the assembly plant.

Expediters are also called upon to follow up orders for raw materials In many instances, they heve been known to rush a supply of materials by car or plane in order to keep assembly lines operating until the bulk of the order arrived Truly, purchasing departments are today procurement departments

SCHEDULING—Outstanding as an element of mass production is the automotive industry's system of scheduling Developed by constant trial-and-error over the years of peacetime manufacture, this method provides for progressive manufacture of weapons Raw materials move steadily from machine to machine, parts converge into subassemblies, finished units flow into subassemblies, subassemblies come together into the major assembly The finished product then emerges

Consider the job of producing 155 mm shells. At peak production, some 25 tons of steel per hour flow into an automotive plant. Thousands of men operate machines, others perform assembly operations Getting the job started and keeping it going demands the full time of experienced master mechanics, tool and die engineers, superintendents, foremen and machinery repair men

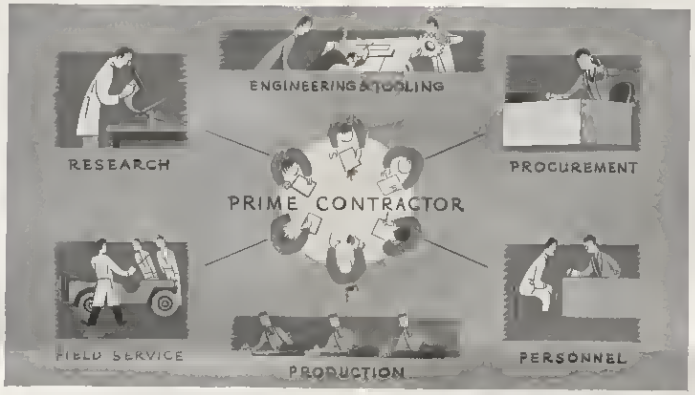
Relying on their years of experience and training in peacetime, such management personnel are adept at studying blueprints and quickly outlining the requirements in machines and manpower required to produce so many units a day, a week or a month.

The thousands of workers who make up the remainder of a manufacturing organization rely on this group for assignment to jobs and direction in those jobs The understanding of machines and the ability to keep them in continuous and efficient production are also the responsibilities of these master craftsmen

TRAINING—The years of experience of automotive prime contractors in methods of training workers has also paid off rich dividends in the war effort of the nation For, to meet its production responsibilities, it has been necessary for automotive companies to train thousands of new workers and to retrain existing employes in the new techniques demanded by many war products Currently, employment in automotive plants is well above the million mark, or more than 30 per cent above the highest peacetime peak

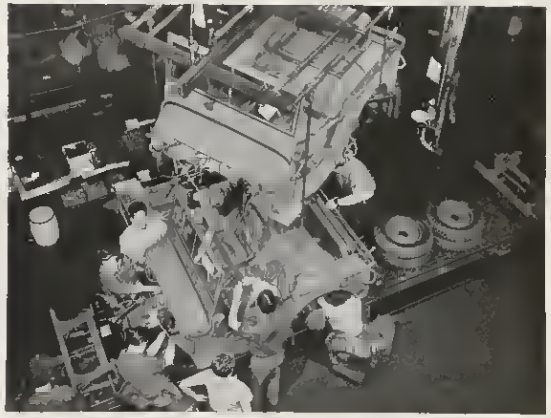
FIELD SERVICE—Such training has also proved of inestimable value, as part of the extensive field service activities of automotive companies The automotive industry has taught thousands of soldiers and sailors how to maintain the products that are rolling from assembly lines. In addition to operating schools in plants, the industry has sent trained instructors to Army camps all over the nation. Also being supplied to the armed forces are tools, instruction books and service manuals

Hundreds of experienced observers many of whom staffed export departments of automotive concerns in peacetime, heve been sent to combat theatres to watch equipment in action and to assist in rectifying shortcomings right on the spot Serious problems that become apparent after contact with the enemy are brought back to plants and put into the mill again for additional research and engineering work



Production-control experience proved an asset to automotive prime contractors

Precise timing of production flow is essential in mass production of weapons



Production Schedules of Automotive Industry Reflect Shifting Strategy of Global Warfare

(Continued from Page 1)

still by one of those sudden changes of demand which, dictated by the exigencies of war, remain unexplained for strategic reasons.

Though the effect on worker morale was disastrous, neither government nor management was to blame. This became apparent later, when the reasons for the change finally were disclosed.

Thus, both management and workers, like the fighters whom they serve, were subjected to one of those bitter lessons of combat—the hard lesson that the dictates of war seldom make for absolute fairness.

Under the accelerating impact of war's shifting demands, automotive assembly lines are increasingly affected by:

1) Changes in design of military products, which may affect a production line, a plant, or a whole network of cooperating factories—for a few hours or for many months, depending on the nature and extent of the change.

2) Lack of materials sufficient to maintain full production, due to difficulties of allocation, distribution, transportation, or any one of hundreds of the dislocations that are common in wartime.

As WPB Chairman Donald Nelson said: "We must try at all times to get the utmost out of our productive capacity, but what we get out of it must differ from time to time. Great as our resources are, they are not great enough to do everything at once. We must make selections and choices as to what to do now and what to do later."

3) Cut-backs or cancellations of production schedules, because materials or machines are suddenly more urgently needed for some other product.

"There are no constants in this war —except the need for enough of everything to anticipate every contingency. And that's impossible. So lesser needs must constantly be subordinated to greater needs. And greater needs today may become lesser needs tomorrow as the scene changes. When there is not enough of anything, first things must come first," the Secretary of the Navy recently observed. "We in the Navy, like you in industry, have been subjected to many disconcerting changes."

Despite such disconcerting changes as have manifested themselves with accelerating frequency of late, the automotive industry is producing at the rate of nearly $1,000,000 an hour. And, with the hope of maintaining and exceeding that productive rate, automotive management today is striving to maintain morale in the face of annoying disturbances. To the problems of manpower is now applied the same kind of cooperative fact-finding as has been brought to bear so successfully by the automotive industry upon problems involving methods, machines and materials used in war production.

AUTOMOTIVE WAR PRODUCTION

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HARRY A. WILLIAMS, Editor

New Center Building, Detroit, Michigan

Machine Tools Get "Temperamental Spells"

They Act Up At Odd Times

MACHINES, like some men, suffer from Monday morning "hang overs." Consider the case of the machine in an automotive plant whose product was consistently perfect—except on Monday mornings when it was just as consistently scrap. Automotive machine tool experts soon discovered this erratic performance was due to the difference in temperature of the machine after a few hours' layoff. Today uniformity of output is achieved by keeping the machine running constantly, with no stops for cleaning and overhaul.

And, sun stroke afflicts other machines! The bizarre behavior of one at a particular hour every day was also traced to a temperature change, this one induced by a sunbeam falling on its working parts.

Thereafter all sunlight was blocked out of the plant and controlled artificial lighting substituted.

In still another instance the periodic inaccuracy of a series of machines was traced, after days of investigation by master mechanics of an automotive concern, to the vibrations caused by a factory truck's scheduled trips through a factory aisle a considerable distance away from the machine line.

DO YOU KNOW?

Workers of the automotive industry have received 120 awards from the War Production Board for outstanding accomplishments on the production front. This is more than 30 per cent of the total number of citations, certificates and honorable mentions presented throughout the nation. One company's workers, alone, top all other firms in the nation with 54 awards.

* * *

Two-thirds of all materials allocated to America's aircraft production program are used in the central states of the country, where many engines, parts, instruments and airframe sections are made in automotive plants.

* * *

An automotive company is currently producing flight instruments ten times in excess of originally-set schedules. Deliveries once thought of in terms of several hundred pairs a month, now amount to many thousands. The automotive method of progressive fabrication and progressive assembly is cited as the reason for this record.

* * *

Automotive war work is spread among small companies in more than a hundred Ohio cities.

With a total of 145 motor vehicle and parts plants, the Buckeye state itself is second only to Michigan in volume of war products delivered by former automotive companies. In just the first quarter of 1943, for example, total sales amounted to $374,000,000.

Civilian Experts Map Out Training Program To Ease Army Transportation Headaches

PHOTO BY U. S. ARMY SIGNAL CORPS.

Soldiers learn automotive maintenance from highly-qualified civilians.

AFTER the 1941 maneuvers of U. S. troops, a group of transportation experts gathered in Washington with Army officials to discuss ways and means of training mechanics and drivers for the Army's motorized equipment.

From the simulated battle conditions, Army officers recognized that it was necessary to intensify its existing personnel-training program to keep pace with the rapidly expanding motorized divisions. Otherwise, the supply of equipment soon would run far in excess of available drivers and mechanics.

The Army therefore turned to truck fleet owners, automobile dealers and others in the transportation field, whose long years of experience in peacetime could well be adapted to this wartime problem.

One of the first recommendations of these men was to bring into the Army experienced civilians who had the ability to train drivers, work with "greaseballs" and advise officers on proper automotive maintenance and administration. To augment the suggestion, the transportation men took on the task of finding qualified technicians who would take the Army jobs.

They began the recruiting by selecting and persuading the best men from their own organizations to go to work for the Army. And, to speed up the drive, they enlisted the help of nearly 400 other transportation experts in the country.

Even though as much as 15 years' experience was required by the Army, the transportation officials have found over 2,000 men with such qualifications. Known officially as Civilian Automotive Advisors, they are the cream of the mechanical supervisors that in peacetime operated and maintained the nation's transportation system.

These men have brought an accumulated total of fifty thousand years of automotive experience to the Army. Most of them are beyond the military age and, in many cases, they have left civilian jobs that paid considerably more than their present remuneration. A ranking Army official has estimated that more than half-a-million soldiers have received training from civilian advisors.

Advisors work in teams of twelve and are assigned to newly-activated Army divisions. They remain with the unit through its entire training period but don't accompany it into combat theatres.

Lt. Gen. Leslie J. McNair, head of training of all U. S. soldiers, who was recently wounded on the North African battlefront, has commented on the importance of civilian advisors to the Army:

"The automotive technicians," he said, "are a new element in our training activities, and have made marvelous headway in a surprisingly short time. All commanders are enthusiastic in their praises of these unusual men. Their effect on maintenance has been startling."

Lower Profits Prevail In Automotive Industry

Survey Shows Drop In '42 Net Earnings

NET INCOME after taxes of 36 automotive companies fell to 4.5 per cent of net sales last year. In the preceding year, net income was 6.7 per cent and in 1940 it reached 8.3 per cent of net sales.

The listed companies include 15 motor vehicle manufacturers and 21 automotive parts companies. Many of the latter have become prime contractors on war work as well as parts producers.

In addition to lower profits throughout the industry, automotive companies have voluntarily reduced prices of war materials, effecting savings to the government of hundreds of millions of dollars.

In a recent release of the War Department, it was shown that American industry as a whole had effected price reductions and refunds on war contracts totaling $1,045,000,000. This was during the nine-month period from April 28, 1942, to January 31, 1943.

Commenting on the job industry had done to keep the cost of the war as low as possible, Undersecretary of War Robert P. Patterson recently declared:

"Additional 'know-how' on the part of industry, expressed largely in the initiative of engineers and technicians in planning and through the application of labor in execution of contracts, has contributed to the saving of billions of dollars and to stepping up further the flow of production."

Highly sensitive aircraft instruments demand precision workmanship.

Automatic Pilots Needed for Bombers Turned Out on Mass Production Basis

A VETERAN engineer, speaking from two-score years of experience in the electrical, aircraft and automotive industries here and abroad, recently observed:

"Whenever high precision has been needed the automobile industry has delivered the goods with something to spare."

This observation is reinforced by the fact that an increasing number of precision instruments for the United Nations' airpower requirements are coming from automotive plants.

Typical is the case of a former automobile accessories company whose converted facilities now are producing automatic pilots, the most sensitive and complex instruments used on bombing planes.

Of the few that had ever been built before, all had been hand-made by watchmakers. While the accessory plant had made precision instruments for automobiles, nothing could compare with the preciseness of this device which costs two and a half times as much as the finest automobile on the market. To prepare for mass-production of the instrument, the accessory manufacturer ripped apart and reorganized the entire network of manufacturing processes in his plant. Three million dollars' worth of machine tools were moved in for the new job.

Once having put the job on a volume basis, the plant began to reduce the product's previous manufacturing costs drastically. Monthly output rate is now well into three figures.

What is an automatic pilot? Designed to maintain a plane's course in a fixed direction at a fixed altitude, the device is an intricate combination of gyroscopic, electrical, electronic and hydraulic instruments. As essential to precision bombing as the famed bombsight used by the U. S. air forces, it is considerably more complex than the bombsight in construction.

In operation, it takes over the job of piloting the plane on a course determined by the navigator, and performs with a degree of accuracy which human mind and muscle cannot match.

Many of the parts and sub-assemblies of these automatic pilots have tolerances ranging from .003 to .0003 of an inch, while other parts allow for no deviation from absolute perfection.

Such limits were recently expressed as follows by an automotive engineer:

"Take an average hair off the human head and slice it lengthwise into 15 strands. One of these 15 strands would about equal the amount of backlash that is allowed as the tolerance between the sector and the worm wheel on the motor bracket assembly.

"Paradoxically," he added, "in this particular part the demand for a minimum amount of backlash is coupled with a demand for the maximum amount of freedom. To attain such perfection, we have had to find operators who have both extraordinary patience and an almost superhuman sense of touch."

Production of the automatic pilot involves two main gyroscopic units comprising 2,184 precision parts, all harmonized and in perfect balance with the complete mechanism. Other parts are made and assembled elsewhere, such as in plants of radio and coin-vending machine manufacturers.

The automatic pilot controls the lateral direction of flight through the plane's rudder. In addition, a vertical unit, controls the up and down motion of the plane through the elevators and ailerons. Each gyroscope spins at a constant speed of 24,000 revolutions per minute.

One of the most ingenious instruments ever devised by man, it is often called "a mechanical brain." Actually, it excels the human brain in ability to calculate the series of adjustments necessary to compensate for each deviating force influencing the ship's flight.

Guard Your Anti-Freeze, Engineers Tell Motorists

WILL YOU love your car in December as you did in May, asks the SAE War Engineering board? To keep your affections high and your temper low next winter, the automotive engineers recommend that you give immediate attention to your anti-freeze solution.

They offer two methods of determining if you can save your present supply for next year when anti-freeze solution is expected to be very scarce.

1.) Dip blue litmus paper in the solution and watch for a color change. If it turns a distinct pink or red, you can discard your anti-freeze. Otherwise, it can be saved.

2.) Allow a sample to stand in a clear glass container overnight. To be useful next year the top fourth of the solution should be clear, water-white, or have a slight tinge of the color of the original anti-freeze solution.

AUTOMOTIVE

WAR PRODUCTION

Vol. II No. 6 | Published by Automotive Council for War Production | June, 1943

Air Power from Production Teams to Combat Teams

Automotive and Aviation Men Pool Their Skills To Boost Nation's Volume of Aerial Horsepower

At Wright Field a few days ago, in a Navy aircraft factory in Wisconsin a few weeks ago, in a one-time automobile factory in New York State several months ago, or at any number of plants in the automotive industry during the past eighteen months, a group of men, once industrial rivals, could be seen putting on a technical "love feast."

Their brief cases, bulging with blueprints and descriptions of manufacturing methods, were open to all. Their ideas, refinements of a lifetime of planning and making and shaping of hard physical things, were tossed out for all to hear and heed and use. Their plants were open for study and inspection by anyone in the automotive or aircraft production field.

Their single purpose: to turn out more horsepower for air power for the United Nations.

The significance of the pattern of industrial teamwork these men have developed is world-wide. Bombers dropping block-busters into German industrial centers are powered with engines which men in this group helped build. The thunder in the clouds of Allied fighters on Axis horizons is the product of their ingenious minds and capable hands. More thunder from more engines is on the way—faster, because of their cooperative effort.

Unknown to the average American, the names of these men are famous wherever internal combustion engines are produced in this, the world's greatest power-producing and -using nation. Master mechanics, engineers, production experts, metallurgists, from the aircraft and automotive industries, they deem internal combustion horsepower "their dish."

This is the Aircraft Engines Committee which, organized by the Automotive Council for War Production just after Pearl Harbor, has now become an important segment of the recently organized Central Aircraft Council. The

(Continued on Page 2)

Cooperation Boosts Allied Air Strength

(Continued from Page 1)

pattern of its teamwork is the evolutionary result of a suggestion offered by leading airmen of the U. S. armed forces back in the summer of 1940, when the Axis plan of conquest starkly revealed itself as a blueprint for a war of horsepower.

At that time it was proposed that our hard-pressed aircraft industry be backed up by our automotive industry's productive facilities, especially its motor-making facilities.

To foster the program, the participants had to sacrifice much. Strong traditions, nurtured by years of competition, had to be forgotten. Hard lessons in cooperation had to be learned. The aircraft industry's master craftsmen gave away freely the priceless accumulation of "know-how" about their art which they had laboriously acquired during a long period of lean and frequently profitless years.

Slowly, at first, but later at a progressively accelerating rate, the old suspicions died, the new lessons were learned, and the group became a team. Its meetings, held once a month, have been attended by more than 150 men, representing 19 different companies engaged in manufacture of aircraft engines and parts. These men assemble, not in a quiet board-room for conversation, but out in the shops, where processes are inspected and copied for mutual improvement, and where questions that would once have been impertinent are frankly asked and freely answered.

In the past year these men have met in nine different factories, invariably with either Army or Navy officers in attendance to facilitate liaison between the men who build engines and the men who fly them. In addition, members have held countless unscheduled sessions in each others' plants, as result of friendships made or invitations issued in "formal" committee meetings. On occasions contractors have even returned to plants once visited, bringing with them suppliers, so a wide network of companies have been encompassed in these cooperative activities.

The benefits that have resulted from this free interchange of information are incalculable. Machining methods have been improved. Production time has been telescoped. Inspection processes have been standardized. The life of cutting and inspection tools has been extended. Exchanges of critical parts have prevented slow-downs and shut-downs. Most of the examples of this mutual aid are never publicized because cooperation has become so matter-of-fact. When they do emerge, it is by accident, in conversation overheard as the men assemble in some shop.

Engineers work together to speed and improve aircraft engine production.

Thus, not long ago, the men responsible for the recent conversion of a Wisconsin motor car plant admitted that, without the help they had had from the other members of this team, their production of powerful engines in quantity for a new type of Navy fighter could not have been attained until next fall. And, in a tour of this plant, the men whose help had been instrumental in getting it started were richly rewarded when they observed how much their own techniques and methods had been improved by the fresh viewpoints of the new users.

Best illustration of this progressive refinement of borrowed techniques is the case of a device for safeguarding inspection gages. About a year ago, one company, faced with a critical shortage of gages, sought to conserve them by building a simple holder for them. Observed in one of the early plant tours of the committee, the holder was widely copied. But, as subsequent tours revealed, each copyist added an improvement, peculiarly his own. Today, virtually every plant has holders which are composites of all the improvements, and the resultant total savings in time and labor and material are immeasurable.

Because of such teamwork, horsepower for air power is rapidly becoming the major product of that department of the U. S. arsenal once known as the automobile industry.

Automotive Plants, Dealers Aid Nation's Salvage Drive

IN THE past 11 months the automotive industry collected nearly 1,400,000 tons of metal scrap, it is shown in a recent compilation.

Of this total, 123,000 tons came from such non-production items as tools, dies, machinery and other equipment. In each of the 11 months covered by the tabulation, collections totaled more than 100,000 tons. March of this year, with more than 154,000 tons of metal returned to the mills, is the highest month on record to date.

Enlistment of the active participation of automobile dealers has also contributed to the nationwide salvage drive. One automotive concern recently received reports from 5,000 of its dealers, showing sales on more than 50,000,000 pounds of scrap materials in the first quarter of 1943 alone.

How It's Done — No. 5 of a Series

PATENTS AND INVENTION

American patent system, stimulating invention and research, has been a major factor in the rapid expansion of peacetime facilities of the automotive industry—facilities that in wartime are making weapons in unequaled volume.

MORE THAN one-fifth of the 2,300,000 patents issued since the inauguration of the U. S. patent system are concerned with the automobile.

This fact shows, with startling clarity, how large a proportion of American ingenuity has been canalized into the development of automotive transportation. And, it emphasizes the role which the American patent system has played in the development of the automotive industry.

From feeble beginnings, the business of manufacturing and marketing motor vehicles became, through a quarter-century of research and invention, the world's outstanding exponent of mass production. And, when war threatened the American way of life, this comparatively young industry, throwing its mass productive might into the grim task of manufacturing weapons, became the hub of the "Arsenal of Democracy."

While most of the basic inventions of the automobile already existed when American pioneers took up the idea of a "horseless carriage," it fell to the lot of ingenious "Yankees" to refine the development, both in terms of product and in manufacturing techniques.

Such refinement has been a never-ending project in the automotive industry. It also has been carried on constantly by those other industries, both large and small, who supply parts and raw materials to the automotive industry.

The drive for better and better products in the automotive and allied industries can be traced to the protection given an inventor under the patent system. With the exclusive right to his product or process for a period of 17 years, the inventor was able to manufacture and market his idea, free from competition of others who had not shared in the lengthy and costly burden of pioneering the development.

No other product has been the subject of more patents than the automobile. On the comparatively small engine spark plug, for example, there have been more than 5,400 patents issued.

As the result of patents and invention, "industries" have been created within industry, as new ideas have been developed and new devices have been brought into manufacture. Important to the nation in peacetime, when it created more employment and increased activity among suppliers, such expansion takes on added significance in wartime, when these developed facilities help swell the outpouring of weapons.

Consider, for example, the method of controlled ventilation that was introduced in motor cars in the early thirties. Its immediate effect was the creation of more than 2,000 jobs in just the one company that developed the process. Four years later this figure had grown to 4,108 employes. More than 50,000 tons of various materials were purchased from other industries, with a total expenditure for labor and materials totaling $25,000,000.

Beyond the preliminary increase in employment of one company, the new development forced competitors to improve their ventilation methods, with a subsequent increase of employment and use of materials.

Today, these facilities have been converted to the manufacture of dozens of different war items. The workers, initiated into the ways of production through this one development, are now applying their peacetime-developed skills to the output of weapons of war.

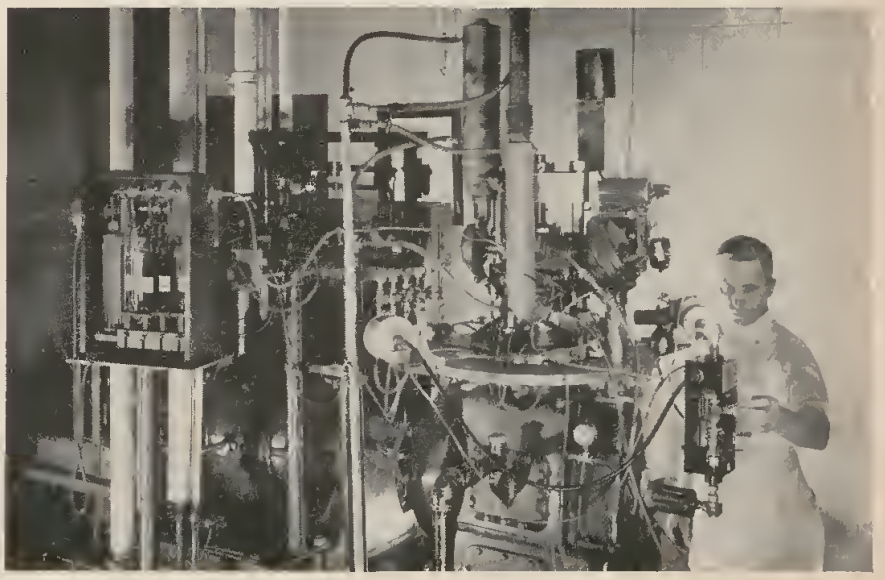
Recognizing the desirability of devoting all its energies to the manufacture and distribution of a product embodying maximum value at minimum cost, the industry has long used patents as a tool of progress. As far back as 1915, an agreement, called cross-licensing, was adopted which made it possible for all firms to obtain the use of each other's patents without compensation or fear of litigation. If each patent owner had attempted to maintain a monopoly on his invention, it would have meant that automotive companies would have been constantly tied up by litigation suits.

Placing the industry on a straight competitive basis, cross-licensing served as a stimulant to research and engineering departments. For, incorporating new ideas into a particular make of automobile, the originating firm had a distinct edge over his competitors in being the first to exploit the improvement to the public.

The Temporary National Economic Committee, which several years ago conducted an investigation of patents, had this to say about the automotive industry's policy in regard to patents:

"It is an expression in common sense of a free enterprise which in less than a generation converted a luxury into a necessity; which, as a latter day miracle, wove the motor car into the fabric of American culture and made its use an aspect of every-day life."

Spurred on by potents, automotive reseorch provides new and better products.



VICTORY POWER

Carrying the Fight to the Enemy, Automotive-Powered Weapons Are in Action on Every Front

IN America's first eighteen months of war, the automotive industry, the outstanding producer of horsepower for useful living has become the world's greatest producer of internal combustion engines for destructive purposes.

Motor car and truck assembly lines that accounted for 85 per cent of the installed peacetime horsepower in America, now expanded and augmented for war, are pouring out engines to power air, land and sea weapons.

In the hands of American soldiers, automotive tanks and trucks are giving herculean performances carrying the fight to the enemy whether the terrain is desert, jungle, swamp or ice. They are being driven over camel trails, reindeer tracks, kangaroo runs, water ox paths and crocodile slides, and even into remote areas where camels and crocodiles are too timid to venture.

U. S. vehicles "at home" on desert sand

A recent report on the battle performance of jeeps tells how two newspaper correspondents drove a jeep through the Chindwin jungles of Burma and over the Manipur hills to Imphel, India."

When they arrived at their destination and reported they had driven from Burma, the officer in charge declared: 'Why, that's impossible. There isn't a single road across these jungles and hills."

'Sh-h-h! Don't talk so loud, cautioned one of the newspapermen. 'Our jeep hasn't found out about roads and we don't want to spoil it!"

From official quarters comes another report:

'Vehicles and roads used to grow up together," said Brigadier General Julian S. Hatcher, chief of Army's Field Service Division recently. 'Now the Army asks only if there is traction or leverage, and if there is we go in and fight."

In action in 70 theaters of war, tanks, trucks and other equipment are bearing out the automotive industry's peacetime reputation of quality manufacture.

In the recent North African campaign, for example, one motorized unit consisting of 166 vehicles went through 32 days of continuous combat with only 12 minor mechanical failures, even though the vehicles had been driven nearly 500 miles across Egypt before the battle area was reached.

Displaying confidence that their weapons would not let them down, the men in the unit went into the fray with daring and aggressiveness. As General Hatcher declared:

"They knew that with proper care, their vehicles would take them into battle and out of battle if it were at all possible. It is known that the tanks in this unit saved the day."

The extent to which the Army is relying on motorization is graphically illustrated in the fact that the 400,000 horsepower of today's infantry division is 125 times the 3,200 horsepower of the infantry division of World War I. Two-thirds of the daily sustaining tonnage necessary to supply a fighting force is made up of petroleum products, and only one-third ammunition, food and daily general supplies. In the last war, the bulk of supplies consisted of ammunition first, and forage for horse-drawn vehicles next.

Supplying this tremendous increase in power are 25 automotive companies building military vehicles. 10 are turning out armored cars and combat vehicles and nine concerns are producing various sizes and types of tanks.

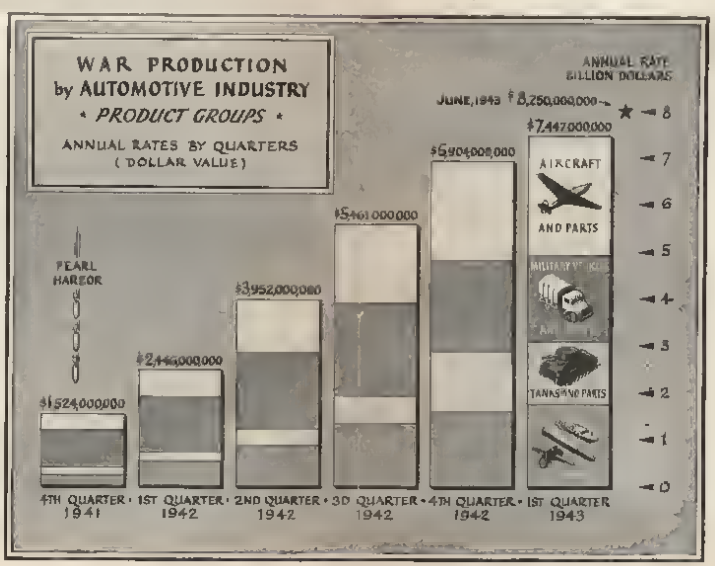
Military vehicles only need traction

Though overall production of military vehicles has been reduced at Army request in recent months as the armed forces have called for more and more aircraft production, the current rate of output is still half again as large as it was on December 7, 1941.

At that time, military vehicles accounted for more than 50 per cent of the total automotive war job. Tank output, which was just getting underway when the Japanese attacked Pearl Harbor, today is running 12 times the delivery rate eighteen months ago.

With eight companies producing aircraft engines in quantity and another now getting underway, the automotive industry has become the nation's largest source of power for the skies. Liquid-cooled engines for many of America's fighting planes are an exclusive development of one automotive company. Another firm is making a British-designed, liquid-cooled type for several R.A.F. bombers and for one of the warhawk fighter models of the U. S. Air Forces. The other seven automotive firms are producing air-cooled engines of various types for Army and Navy bomber and fighter planes.

Under the impetus of this flow of airpower, aircraft material has become the No. 1 war product being delivered to the government by the automotive industry. In May completed planes, airframes, engines, propellers and parts accounted for nearly one third of the estimated delivery total of automotive companies of $675 million worth of war goods. In the eighteen months of war, the rate of aircraft deliveries has increased seven times.



AUTOMOTIVE WAR PRODUCTION

Horsepower for the Navy is also emanating from the plants of former automotive companies. Power plants for torpedo boats, submarines, and scores of small craft are coming from the automotive industry. One company, alone, is making more than half the Diesel engines the U. S. Navy uses. Deliveries of marine equipment are nearly six times greater today than they were on December 7, 1941.

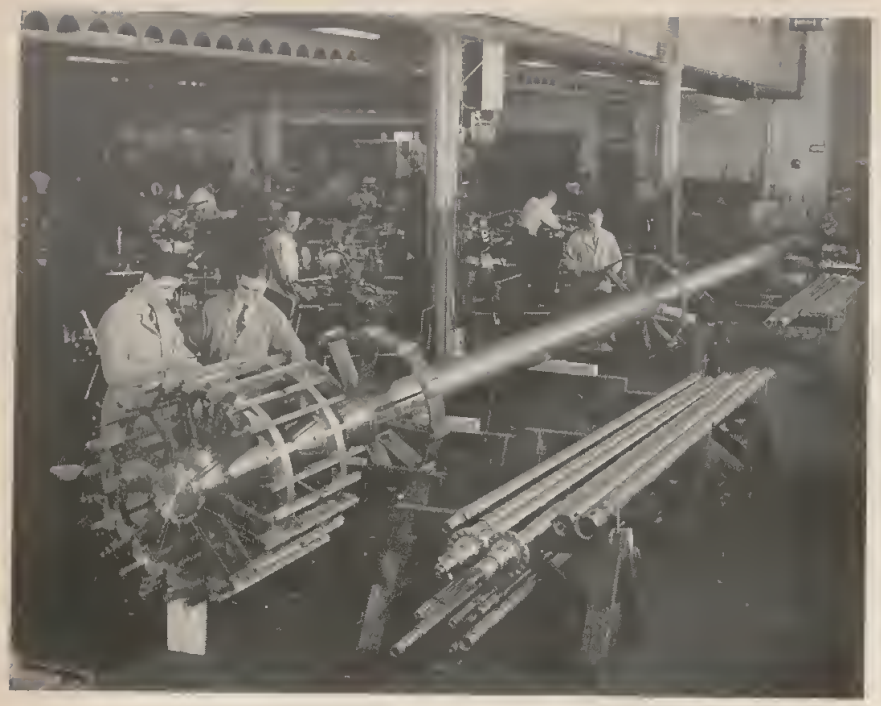
Firepower as well as motive power, makes up a considerable portion of the automotive war job. Machine guns, cannon of various types, carbines, aircraft and anti-aircraft guns are pouring from automotive assembly lines while dozens of plants are turning out shells and ammunition. Gun deliveries have increased seven times in the eighteen months of the war. Deliveries of ammunition increased six times.

While the increase in production of all types of war goods is of epic proportions, industry statisticians point out that available figures understate the progress that has been made by the automotive industry in the eighteen months period. Based on monthly dollar volume reports from individual companies, the figures fail to take into consideration the reductions that have been made in the unit price of war products. Improved designs and more efficient manufacturing processes have enabled automotive companies to effect savings of hundreds of millions of dollars on war orders. Thus the physical quantity of planes, tanks, guns and trucks being delivered to the government is considerably higher than the dollar volume trend shows.

Automotive horsepower provides its own roads through dense jungle and swamps.

Through the introduction of thousands of women into war plants of the industry, automotive companies have continued to swell their employment rolls each month. During May, it is estimated there were more than 1,050,000 men and women on the payrolls of 772 automotive plants. This is an increase of more than 50 per cent since the attack on Pearl Harbor.

Zero weather taken in stride



Three-ton honing tool, world's largest, is built for war job.

Automotive-Developed Honing Process Applied To Production of High Quality War Material

A GIANT tool, one-fifth the length of a football field, is now in operation smoothing the surfaces of mammoth weapons of war.

Called a hone, this particular device is the largest on record. Its principle is an old one, and its application has been extensive in the automotive industry, where honed cylinders, bearings and other parts have given longer life to passenger cars.

Though the origin of industrial honing dates back to the first World War, the method has been adopted extensively in just the past 10 years, and then only after lengthy and costly research by automotive companies.

Today, it is being applied to virtually every war product which contains a hole that must be round and smooth.

This largest of all honing tools, recently shipped to a war contractor by an automotive supplier, is 41½ inches in diameter, 63 feet long, and weighs approximately 6,500 pounds. It is to be used in a bore 40 feet long, removing about 1/16 of an inch of metal from the inner diameter of the tube. This will amount to nearly 2,000 cubic inches of metal removal, or more than 550 pounds of metal shaved off by the process. The tool, to be used in a special horizontal honing machine, had to be broken down into three parts to facilitate shipping.

The honing process is understandable to anyone that has ever sharpened a knife or razor. By the application of special-type stones to a rough or dull surface, a smooth, highly polished finish is obtained.

Automotive Workers Lead Nation in Bond Purchases

NOT ONLY is the automotive industry the top producer of war goods, but its employes are also leading all other industries in the nation in the purchase of war bonds through the payroll savings plan.

Currently, according to an analysis of the Treasury Department, Division of Research and Statistics, more than 90 per cent of automotive employes have authorized regular deductions from paychecks for war bond purchases. The automotive industry's average bond sales of 9.1 per cent of payrolls was the highest total of the 32 industries covered in the tabulation. The second highest industry group in the tabulation showed average sales of 8.8 per cent of total payrolls.

High-Octane Gasoline Rushed by Tank Truck

WITH the tight shipping situation in the nation demanding the most efficient utilization of transportation facilities, motor vehicles are assuming new wartime jobs.

Tank trucks, for example, have now taken over the job of hauling high-octane gasoline to military airfields throughout the country, thereby releasing thousands of railroad tank cars for longer trips.

In supplying the needed fuel for America's growing number of warplanes, trucks are working on a round-the-clock schedule, delivering millions of gallons of gasoline daily to virtually all the airfields in Florida, Georgia, Alabama, Mississippi, Louisiana, and about half of Texas.

To expedite the movement of the oil arriving in the critical Eastern area, large over-the-road transports are moving the fuel from terminals to bulk plants, while smaller local delivery trucks pick it up there and distribute it to millions of home and commercial consumers.

Through the use of trucks in this program, more than 14,000 railroad tank cars have been released from short-haul duty. Thus, many are now concentrating on cross-country hauls, carrying the oil which formerly moved to the East by ocean tanker.

The use of trucks in hauling petroleum products is far from being a wartime stop-gap. Rather, they are proving highly efficient and economical. Figures of the Office of Defense Transportation, for example, show that a single tank truck unit can do the work of about 12 railroad tank cars on hauls up to 100 miles and of about six cars on hauls of 100 to 200 miles.

AUTOMOTIVE WAR PRODUCTION

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Automotive Council
for War Production

HARRY A. WILLIAMS, Editor

New Center Building, Detroit, Michigan

Tool-and-Die Shops Deliver in Hurry

Nation Beating Path To Toolmakers' Doors

PROVING once again that the better "mousetrap builders" never lack for business, the small, independent manufacturers of automotive tools and dies are finding a well-grooved trail leading from all parts of the nation to their doors.

More than 80% of their current orders are coming from outside Detroit, the proverbial source of their business. Plants as far away as California and Rhode Island have representatives beating a path to these mid-west shops.

To utilize their wealth of skill, an aircraft company recently came to Detroit to completely tool up a new type warplane. The Pacific Coast manufacturer plans to build several of the new-type planes before the production equipment is crated and shipped back to the assembly plant.

As contact with the enemy calls for innumerable changes in war products, Detroit's tool makers are rushing orders to completion in record time.

A New York concern needing a quick change in a fighter plane placed blueprints in the hands of several automotive tool firms at nine o'clock one morning and by four in the afternoon he had a cost estimate and a delivery promise of three weeks. Furthermore, all tool makers lived up to delivery schedules, some even completing their job days ahead of time.

In another instance, an aircraft subcontractor was given an order for automatic gun turrets which had to be installed on a bomber to eliminate blind spots that showed up in combat. Stymied, momentarily, for the necessary jigs and fixtures, the subcontractor placed the job in the hands of Detroit companies and got the tools in 10 days.

Stemming from more than two decades of experience in supplying tools to automotive companies, the ability to rush a job through in a pinch is today second nature to these skilled tool men. And, to meet the demands of all comers, it has been necessary for their employes, the highest paid tool makers in the nation, to work 'round the clock. Their machines and equipment have been wearing out four times as fast as in normal times.

Living commodities are rushed to rural areas by highway transportation.

Despite Wartime Shortages, Motor Trucks Maintain Service to 54,000 Rail-less Towns

IN SPITE of wartime difficulties, motor trucks continue to perform herculean service for the 54,000 communities not served by railroads.

Many of these rural towns, located as far away as 100 miles from the nearest railroad, are relying on highway transportation to bring in the necessities of living—food, shelter, clothing and heat—and to take out war materials, agricultural goods and other products.

Consider the recent survey of 644 firms in 12 counties of South Dakota. Even though some of the communities represented are within range of rail service, they were dependent almost exclusively on trucks for the 52.5 per cent of their commodities that came from outside the vicinity.

Over-the-road transport brought in nearly all of their meats, bread, fruits and vegetables, and more than three-fourths of their dairy products. They, in turn, shipped by truck all of their eggs and poultry, nearly half of their dairy products and 10.5 per cent of their grain produce.

During one typical week in Carroll County, Missouri, more than 900 tons of goods were received, of which 67.3 per cent were sent in by motor carriers. Accounting for an even greater percentage of outgoing materials, trucks carried away more than 82 per cent of the goods that left this rural mid-western area.

Under wartime circumstances, however, truck operators are finding it increasingly difficult to meet such demand. A recent cross-section analysis of the 54,000 rail-less communities showed that 49 per cent of the reporting towns were experiencing transportation difficulties due to lack of repair parts; 33 per cent to lack of vehicles; 33 per cent to shortages of mechanics; 19 per cent to shortages of drivers.

A typical comment came from Moab, Utah, where trucks are hauling vanadium ore:

"While not alarming at the present time, the lack of replacement parts is becoming critical and the outlook here is that a number of trucks which need repair will not be able to continue operating. This would cause a decrease in the output of this important metal, since this area is served entirely by motor truck transportation."

Production of U. S. Warplanes Is Boosted By Automotive Technique of Zero Welding

IN ITS quest for better products at lower cost, the automotive industry carries on extensive experiments to find new materials and new methods. Though such research often turned out to be of no immediate use in the manufacture of cars and trucks, it is today being brought down from the "shelves" of the industry's laboratories to aid in the drive for more and better weapons for the United Nations.

Take the case of zero welding which is now being applied to the production of American warplanes, with a saving of thousands of precious hours of manufacturing time.

The application of cold to the hot points of arc-welding devices stems from several automotive factories where it was tried in the manufacture of assembled sheet steel stampings. With the advent of war, automotive engineers, seeking short-cuts in aircraft production, revived the idea and began more thorough exploration. Such striking results were attained that all aircraft manufacturers became interested.

It was found, for example, that, in putting the 1,600 spot welds on a single bomb bay door, operations had to be halted more than 45 times to clean the welding points; but, with temperature of the electrodes reduced to zero Fahrenheit, 800 successive welds were possible.

The total saving is estimated to be two and a half hours on just one bomb bay door. And, as an operator and two helpers are required for welding of this large unit, more than seven man-hours are thus saved. With four bomb doors installed on each plane, the savings on this one part alone are considerable.

But, important though it is, time-saving is not the sole benefit of this welding technique. For, since there is less heat at the electrode tips, the aluminum alloy sheets are subjected to less heat expansion. There are, therefore, fewer buckled sheets. Moreover, as high temperatures in the electrodes tend to drive contaminating copper into the welds, the use of refrigerated tips produces stronger welds.

Zero welding came about when normal spot welding caused the grain structure of the aluminum alloy to change at the boundaries of the welds because of heat set up around the welding points. Such changes remained hidden until later stresses revealed them as cracks or breaks.

After a series of experiments with ways to defeat the destructive effect of heat, automotive engineers built a refrigeration device which was capable of pulling the temperature down to 85 degrees below zero.

Then experiments in welding began on sheets of various thicknesses, and at tip temperatures ranging from 25 degrees to minus 85.

As the engineers went to the lower temperatures they were balked by the formation of ice at the welding tips. To counteract this effect, they allowed acetone in the refrigerating system to squirt on the electrodes.

Every step of the experimentation was carefully documented so all companies engaged in aircraft work could profit from the experience. All the experimental welds were rigorously tested, and a library of photomicrographs was compiled on the subject. In addition, time-saving methods were devised for the mechanical cleaning of the parts to be welded as well as a simple method of cleaning and restoring the contour of electrodes without removing them from the machine.

All of the details of these new techniques were freely shared with all other American manufacturers of warplanes. As a result of this teamwork, the bomber teams of the American armed forces are now steadily assuming more and more of the command of the air over the fighting fronts.

Pullman, Airliner Seats Give Way to "Victory Cargo"

FREIGHT is riding in pullman space these days, as vital parts and materials are rushed from plant to plant, in order to keep war production lines operating at peak schedule.

Aircraft production at a Wisconsin plant of the automotive industry, for example, was recently threatened until an engineer rushed to a supplier in Ohio and brought back several boxes of special parts in his lower berth. Assisting the supplier in overcoming a production problem, the engineer was able to obtain a sufficient number of parts to keep his assembly line operating until a full shipment arrived two days later from the supplier.

"Victory cargo" is also taking over seats on passenger airplanes. A recent case was the loading of a large crate of parts into two front seats of an airliner that was heading for Fort Wayne, Indiana. Four men were waiting at the airport to unload the crate and rush the parts to an automotive plant.

AUTOMOTIVE
WAR PRODUCTION

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War Output Continues Rise, Despite Conversion No. 2

Keeping Step with Shifting Military Requirements Calls for Many Changeovers in Automotive Plants

CONTRASTED with the tumult and turmoil of changing from motor cars to munitions, the automotive industry's "second conversion" has been a noiseless, unspectacular affair, though a most important one.

Like its predecessor, the latter day conversion has been accompanied by shifting of facilities, re-arrangement of machinery, pioneering of new methods and emergence of new products, some totally different from those which have rolled off the production lines before.

These products range from heavy trucks that swim like ducks, and which already have waddled with blazing guns into enemy positions, to 40,000 pound mounts for huge Navy guns which are proving such potent weapons in the current invasion thrust. These mounts are used on guns similar to those shown in the above photo.

To a considerable degree, the grand strategy of the United Nations is keyed to the speed with which the conversion to the newer weapons is made, in order to assure a balanced program for land, sea and air fighting.

Dictated by the shifting strategy of war, military requirements constantly are being revised. Some items have slowed down in recent months in automotive plants, while others have been halted altogether.

Military vehicle production, for example, provides a case in point:

In the last quarter of 1941, at the time of Pearl Harbor, military vehicles constituted 52 per cent of the total automotive war job. Twelve months later, it amounted to 29 per cent of the total production and, by April of this year, it was down to 25 per cent. A similar situation, though not quite so pronounced, exists in the tank and gun phase of the automotive war job.

Aircraft work by the automotive industry has come forward rapidly, accounting percentagewise for much of the drop in trucks, tanks and guns percentage totals. However, cut-backs of schedules and contract cancellations are also reflected.

Nevertheless, the automotive industry's production totals have continued to climb to new highs, month by month,

(Continued on Page 7)

HELP WANTED: FEMALE

Good Morale Programs Begin at the Factory Gate, As Automotive Plants Add More Women Workers.

While employment procedures vary widely, outlined below is an example of a personnel program developed by one automotive company. It shows the steps taken by a "typical" applicant, in this case a woman, in getting her first job in the company.

SO YOU *wish to do your part by becoming a war worker.*

In an automotive war plant, your first interviewer asks you to fill out an application form to see if your qualifications fit the available jobs. Then you are directed to the employment office.

If you've specific training, the employment manager puts emphasis on placing you in a job which will utilize your highest skill. Then, your weight, height and age are matched against the physical requirements of the available jobs.

Are you a short person? If so, he rules out jobs requiring you to work with hands outstretched over your head. If you are quite tall, then you shouldn't be assigned to a job where you'd have to lean down in a bent-back position. If your educational background is above average, then a highly repetitious job should be waived in favor of one calling for greater exercise of the mind.

If you are a woman—as many recruits today are—you are turned over to a woman counselor, once you are hired. The counselor, a mature. understanding person, explains that her job is to help you become acquainted with the plant and its policies, and to help you with your problems.

Matching workers and jobs.

"I know there are times when things come up that are personal or confidential," she says. "If that happens, won't you come in and talk them over? We may be able to help you straighten them out and save you embarrassment."

She explains the importance of the job that is waiting for you, and how vitally necessary it is to keep producing war materials for the men at the front.

She reminds that you should protect yourself and fellow workers against accident hazards at all times. The first safety rule, she says, is "Don't Run!" The second, "No Horseplay."

The clothing you wear should also be selected with safety in mind. Slacks and a shirt or blouse are required. Angora sweaters are out—they are fire hazards. Jewelry is not recommended. Sensible shoes are an important item in your wardrobe, she points out. You should get low or medium heeled shoes, well fitted, which both support and protect your feet. Protect your hair with a snood or a turban while you're on the job; loose hair catches in things.

Do you have adequate transportation to and from work? the counselor wants to know. If not, she explains the plant's share-the-ride program and tells you how you can participate.

Now let's go see what your new job is like, the counselor suggests. In escorting you to your department, she points out first aid and rest rooms on the way. Other landmarks in the plant are brought to your attention to help you get directions straight.

She takes you to the superintendent's office where you register and get your badge. Shift hours are explained, and you are told when to report to work. A trip to the time clock acquaints you with the technique of ringing your time card. You now are introduced to the foreman, who briefly describes to you the work that is being performed in the department where you will work.

The counselor takes you out of the plant by the same route, to help you get your bearings, then turns you over to the training director for instructions on your new job.

He explains the job, listing the principal steps, emphasizing the key points. Everything is ready—the tools you are to use, the equipment, the materials.

Running through the job, he takes up one step at a time and shows you how to do it. He repeats the operations. Then he asks you to perform them. Now he requests you to turn instructor and tell HIM how to do the job.

Once you show sufficient familiarity with the operations, the instructor puts you on your own. He checks you frequently to see if you are following instructions. You begin to look for key points, begin to ask questions: "Why is it done this way?" "How do you correct this?" "What's the purpose of this?"

After you begin to show satisfactory progress, the instructor starts tapering off his extra coaching and close follow-up. Now you ask his advice and help only when something unusual is encountered. Soon he tells you:

"You've got the hang of the job now. Report to your departmental foreman tomorrow. You are ready for actual production."

You go home, tingling.

YOU ARE A WAR WORKER.

The above procedure of an employee's first days on the job, patterned after the personnel program of one automotive company, points up a series of problems common to all.

In the period ahead, a big influx of new workers is expected in U. S. industry—young women and middle aged women, old men, physically disabled people, and many other persons entirely new to industrial jobs. The biggest source of new workers will be found among women, however.

"By the end of the year," Paul V. McNutt, chairman, War Manpower Commission, recently explained, "there will be nearly eighteen million women in the labor force, one-third of those in direct war production. These facts mean adjustment for the worker and adjustment for the employer."

The newness of the relationship between the employe and her job has prompted industry to undertake extensive study of ways to make the new

Automative industry shares "know-haw," in cambatting manpawer prablem.

worker feel at home in the plant.

Groundwork for good morale in new employes is laid in adequate preparations for their hiring, experience in the automotive industry shows. First impressions often are lasting ones. Therefore, care is taken with such details incident to hiring as providing waiting rooms with seats and writing desks. Applicants are interviewed as promptly as possible, treated courteously, and upon being hired are warmly welcomed into the company. Pains are taken to explain to the new employe how he or she fits into the organization and the part the company's war products are playing in the war effort.

Women counselors, generally, are new to industry, having come into the picture since the number of female employes began to increase sharply. Not all automotive companies have them, and some that do apply other names to them, such as "matrons", "floor area supervisors," etc.

One automotive company with a growing number of women workers on its employment rolls has 34 women counselors on the staff. It is estimated that they talk to 250 women a day, either for job induction or to assist in overcoming problems of a personal nature. The counselors range from young well-trained social workers to elderly women who have raised large families. Their average age is about 40 years.

Another plant assigns one counselor to a given floor area in each department in which women are employed, and this woman acts as a "big sister" to the newcomers who are not accustomed to factory work. Among other duties, the woman counselor frequently goes to the foreman with matters of health or hygiene that the newcomer is reluctant to discuss with the foreman.

The entrance of women into industry has necessitated, in many cases, the expansion of plant hospitals and first aid stations. Safety rules set up for men have to be revamped for women, even though the latter may be performing similar operations. Separate rules are frequently required to point out the importance of low-heeled shoes, short fingernails, completely enclosing the hair, removal of rings, wearing of safety clothing. Plants in some cases have even rearranged or reprocessed the work to make it safer and more satisfactory for women.

Up to now the automotive industry has experienced less difficulty in attracting workers than almost any other industry in America. But with a manpower pinch looming in the future the various companies some months ago began to aid one another by exchanging "know-how" on methods of meeting manpower problems. Therefore, through the Automotive Council for War Production more than 500 companies in the automotive industry have undertaken cooperative action in this field, just as they did in meeting machine tool shortages during the conversion period in the days following Pearl Harbor.

Specialists of the industry have huddled over conference tables trying to map out the best procedures for caring for the new employe from the moment he or she fills out an application blank for a job in an automotive war plant. The nature of the industry's studies are indicated from some of the preliminary reports issued to date: Training and Upgrading; Worker Morale; Incentive Plans; Absenteeism; Personnel Policies; Housing and Transportation; Health, Safety and Nutrition; New Workers.

But as the manpower program is a changing one, the industry will not rest on the knowledge gained to date; rather, the industry's manpower experts will continue to cull the field for new ideas and effective results, so that production for Victory will not falter with the increased demands on the nation's manpower resources.

IT'S DONE WITH MIRRORS

To a man it seemed right to plan the women's restrooms so that each wash basin would have a mirror directly above it. Indeed, pride was openly expressed by the personnel men who had just applied "the feminine touch" to this automotive plant's facilities in preparation for an influx of women workers.

But—

"It just goes to show you how little men know about women," said the company's woman counselor after one glance around the ladies' room. Summoning the maintenance foreman, she ordered the mirrors removed to the opposite wall, away from the wash stands.

"A woman," she explained, "spends more time primping than she does washing her hands. So a mirror over a wash basin is a bottleneck in a powder room."

To which the crestfallen male planners meekly replied with the apology, "After all, we've never been in a powder room."

BATTLE FOR RUBBER

Automotive and rubber research have progressed hand in hand.

WHEN the history of the present conflict is written, one of its most dramatic chapters will be the thrilling battle for rubber.

Recording it, the historian will be able to recall how Japanese treachery swept the United States to the brink of disaster in 1942, and how "Yankee ingenuity" transformed the blackest prospects of defeat into the brighter prospects of victory within the brief span of a year.

Today, the Japanese still hold the bulk of the world's rubber plantations which they seized a year ago—but, thanks to one of the greatest industrial achievements in history, the United States will produce more rubber next year than this nation, the world's largest consumer of rubber, ever imported from plantations in peacetime.

At Institute, West Virginia, a new plant, sprawling out over 77 acres of what was weed-grown river bottomland a year ago, is now turning out man-made rubber at the rate of 90,000 long tons a year. This plant's output—as much as 100,000 plantation workers gather from 18,000,000 trees—is derived from chemical transformations of products from American acres and American mines.

At one end of the huge plant alcohol, ethylene and benzene are received. The alcohol, derived from either grain or molasses or petroleum, is processed into butadiene, a gas which turns to liquid at low temperatures. The ethylene and benzene are combined into styrene, a liquid which solidifies into a transparent plastic under certain conditions. Brought together in their liquid forms, the butadiene and styrene are combined by a series of chemical and mechanical processes into a crude "rubber" which, like natural rubber, is sent to rubber factories to be made into finished rubber products.

Week by week, month by month, other similar plants are being completed—in Pennsylvania, Kentucky, Louisiana, Texas, California, Ontario, and elsewhere. At the present rate of increase in productive facilities it is now estimated that, by the end of 1943, the nation's output of synthetic rubber will be rolling at the rate of 850,000 tons a year—considerably more than we ever drew from the plantations now held by our enemies.

The magnitude of this industrial accomplishment is hard to visualize. Of it, one observer recently said, "It was much as if we had decided to create the automobile industry in two years instead of 40."

That the grave danger of rubber starvation is diminishing so rapidly today is a tribute to the dogged determination of William M. Jeffers, the railroad executive who was drafted from the transportation industry to head the synthetic rubber program.

But that mass production of synthetic rubbers, as suitable substitutes for the more than 35,000 uses to which natural rubber had been adapted, is today a reality is due to the fact that other men—most of them relatively unknown—were working on rubber research years before the Axis formulated its plot against the U. S.

Shortly before his death in 1931, Thomas A. Edison warned: "In the next war, one of the first moves of our enemies will probably be to cut off most of our supply sources of crude rubber, so I am turning my attention to the producing of synthetic rubber."

Edison's alarm was not exactly unique. There were other far-sighted Americans who were acutely conscious of the perils inherent in the fact that the United States, using as much rubber as all other countries put together, was almost entirely dependent on the maintenance of a thin lifeline stretching half way around the world. This consciousness of national danger was especially pronounced among scientific men associated with the research laboratories of the American chemical, automotive and rubber industries.

In the years between the two World Wars such men proposed that steps be taken to provide for the development and production of synthetic rubber as insurance against the contingency of war, but neither government nor the public recognized the merit of their proposals. So, in a few industrial laboratories, the exploratory work went on, generally on a small scale.

It was natural that most of this exploratory work should be rather closely related to automotive industry

HOW IT'S DONE

No. 6

SYNTHETIC RUBBER

Japan's plot to control rubber supply is undone by the inventive ingenuity of free Americans working together for an outstanding industrial achievement.

research, for the motor vehicle accounted for the bulk of the world's total rubber consumption. Originally, much of this early research was aimed at the adaptation of natural rubber to the tasks imposed upon it by the automobile—tasks for which natural rubber is notoriously unfit by reason of its deficiencies in the presence of petroleum products, heat and sunlight.

The research laboratories of the American tire industry were for more than two decades the principal battlegrounds upon which men fought to improve natural rubber's resistance to the destructive effects of gasoline, grease, lubricating oil, sunlight, heat and age. Their success is attested to by the fact that the average life of the automobile tire was multiplied scores of times in the period in which they applied their ingenuity to the task of rubber improvement.

And, as more tasks were found for rubber in the motor car and in its attendant services, the attention of automotive and rubber industry researchers turned more and more toward investigation of synthetic rubbers which could be "tailor-made" to perform specific duties for which natural rubber could not be adapted.

Though these synthetic rubbers were invariably much more expensive than natural rubber, their use was often justified by the fact that they performed better and lasted longer. So they got into such places as filling station hose, where natural rubber could not stand contact with gasoline; and in automobile engine mountings, water pump gaskets, fuel pump seals, carburetor diaphragms, ignition cables, grease retaining boots on propeller shafts and universal joints, etc.

By 1940 there were as many as 75 of such synthetic rubbers on one model of a low-priced automobile.

Indeed, the synthetic rubbers had become so essential to the efficient performance of automotive transportation that, by spring of 1941, when one of the synthetics became scarce as a result of wartime demands for one of its chemical components, automotive engineers were suddenly confronted with an emergency need for a mechanical design change because natural rubber, then still available, was not suitable as a replacement.

But, in contrast to the quantity of natural rubber used annually in the United States, our total consumption of such synthetic rubbers was small indeed. Germany, struggling for national self-sufficiency under the drive of Hitler, pushed forward rapidly in this field, producing eventually a type of synthetic rubber with a claimed superiority over natural rubber for use in automobile tires.

The Soviet Union, conscious of the threat of war from two directions, also spurred its chemists into accelerated activity in the development of domestic sources of both natural and synthetic rubbers.

In 1940, when the war in Europe began to spread alarmingly fast, the ominous forebodings of America's farsighted rubber experts began to receive more serious consideration than they had been accorded previously. Government and the rubber industry began to study the problem long before Pearl Harbor; but not until that blow was struck could the nation's rubber specialists hazard the danger of prosecution on monopolistic charges with an "all-out" pooling of the "know-how" they had developed and perfected competitively.

Among the heroes of this saga there are scores of men who worked anonymously to get things going, many of them men whose names will perhaps never be known by the public whom they served. Determined men, they compressed a decade of development into two years. In doing so, they risked much; for, almost without exception, the gigantic and intricate synthetic rubber plants now going into production were daringly created without the customary intermediate step of trying out in a pilot plant a process that looked merely promising in a small-scale laboratory experiment. One commentator said it was "almost like building a Flying Fortress out of the experience of flying a kite."

Cooling 20,000 gallons of water a minute.

"It was a desperate gamble," one of the chemists associated with the program said recently. "But the stakes called for it, for those stakes were nothing less than the destiny of our nation. We now know that we need never be so helplessly dependent on distant plantations again."

"Meat grinder" breaks up large pieces of synthetic rubber.

Jeeps and trucks aid in speedy recovery of U. S. bottle-wounded.

Automotive Equipment Provides U. S. Soldiers With Hospital Facilities at Battle Fronts

WHEREVER American soldiers are fighting, the finest hospitals in the world are ready at all times to take care of battle wounded.

How can they build hospitals at the front? Well, they don't have to. For in the mobile units, that are coming from the assembly lines of the automotive industry, the Army has at its command medical facilities which are comparable to the most modern hospital in the country.

Take, for instance, the battalion aid station which operates from 400 to 1,000 yards behind the battle lines. This station, which is a minature hospital on wheels, is the first to receive the wounded soldier. Comparable to the emergency room in an ordinary hospital, it is staffed by two physicians and assistants and is equipped with operating instruments, sulfonamides to fight infection, anesthetics and opiates to relieve pain, hot drinks and blood plasma to combat shock and loss of blood.

After remaining long enough to receive necessary treatment, the soldier then is evacuated by ambulance-jeep or other conveyance back to the collecting station, much the same as being taken from the emergency room of a hospital to a ward for further treatment. This, too, is mobile, and can be brought up as close to the front line as necessary. Here complete records are maintained as to type of injury, recommended treatment, etc. Charts and orders of the physicians are as carefully maintained as in a large city hospital.

From the collecting stations the more seriously wounded are evacuated to field hospitals. Though these are also highly mobile and can be brought up to the front, they are usually maintained some 5 to 7 miles back of the battle line. The field hospitals are six-wheel units, capable of rapid movement over rough or soft ground. Equipped with the most modern medical and surgical supplies, they are staffed by expert surgeons, with specialists available for all kinds of injuries.

Farthest back are the base hospitals which are not mobile. Wounded men are brought to them by ambulance or ambulance-plane, since many are far removed from the battle area.

The automotive industry also provides other units which are used to care for battle-wounded or to maintain the health of American fighting men. These include bacteriological laboratories, and optical and dental units. Vehicles are used also to carry such equipment as X-ray machines and water purifiers to the front. A recent development is a trailer-borne plant which, designed for beach landings, distills ocean water into fresh water.

With such emphasis on medical care, it is apparent why recovery of wounded U. S. fighting men is running at better than 97 per cent.

22,000 Firms Share Automotive War Job

MORE THAN 22,000 individual companies located in 1,265 cities and 43 states are participating in the war job of the automotive industry, according to a preliminary subcontracting compilation by the Automotive Council for War Production.

Small business plays a big part in the industry's work. A number of plants employing 75 workers or less help build hydraulic brake controls, in a network of 38 small and medium-sized subcontractors working on the job. Interestingly enough, four of these plants have only two employes each, a "boss" and his assistant.

On another job, an automotive company has enlisted the help of 199 subcontractors. Sixty-two of these employ less than 100 workers each, 78 range from 100 to 500 employes, with the remaining 59 each employing more than 500 workers.

Automotive Plants Save Rubber, Copper and Tin

COMBINING ingenuity and enterprise with their background of "know-how," automotive engineers are assisting the nation to stretch its supply of critical materials.

On just a single Army vehicle, for example, a total of 107 items formerly made of rubber are now being produced from less critical materials such as felt, cotton, fabric, plastics and synthetics by an automotive company.

To concentrate the limited supply of copper into those weapons where it is irreplaceable, the automotive firm has re-designed 129 parts, turning to lead, felt, steel iron, plastics, die casting and other materials.

Of the 57 items on the vehicle formerly made of tin or tin-alloy base, automotive engineers substituted various materials and processes, among them being leather, felt, steel and iron.

Conversion Continues

(Continued from Page 1)

a testimony in itself to the speed with which the industry is converting.

In May, when the nation's overall arms output lagged, as revealed by War Production Board Chief Donald M. Nelson, the automotive industry showed an increase over the previous month by more than $25,000,000.

A 4500-pound amphibious truck, capable of carrying many soldiers over land or water, recently was put into production by one automotive company, taking up the slack caused by the lessening demand for standard military vehicles. The first of these units was engaged in actual testing operations only 38 days after the company received the original letter of intent from the War Department.

Geared for swift action, another automotive company is losing no time in converting anti-aircraft gun facilities —partally idle due to recent contract cut-backs—to production of 40,000 pound 5-inch dual purpose mounts for the Navy.

Having entered the machine tool field when a serious shortage existed there, another company has now shifted away from this work and into the production of gun breech housings.

Easing up of the tank program has resulted in one tank hull manufacturer turning to production of aircraft wings; another company, while continuing to make M-4 tanks in reduced quantities, has converted one assembly line to tank destroyer production and is preparing its plant for work on another armored vehicle; still another getting away from tank production altogether, is going into production on prime movers, huge vehicles needed by the Army for heavy hauling.

AUTOMOTIVE WAR PRODUCTION

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HARRY A. WILLIAMS, Editor

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Fundamentals of engine care is part of automotive tractorette training.

Women Learn to Operate, Service Tractors Under Automotive Farm-Training Program

LIKE THEIR city sisters in war plants, farm women are now taking men's places "behind the plow," helping to provide more food for Victory.

Under a program of a former automotive manufacturer who also was one of the nation's largest tractor producers, thousands of women in all parts of the country are learning to operate and service tractors, so that they can take the place of a brother, son or husband gone to the wars.

The plan was originated shortly after Pearl Harbor when it was apparent that the farm labor shortage was becoming acute. Dealers of the company were called upon to furnish classrooms, instructors and machines, while the manufacturer provided teaching manuals, slide films, drawings and service charts.

All that was required of prospective tractorettes was a desire to learn and a disregard for grease under fingernails and smudges on noses, plus a farming background. The program was instantly and enthusiastically received. Enrollment lists showed wives, sisters, daughters, mothers and even grandmothers were participating. Ages ranged from 16 to 65.

Though their menfolk were a bit skeptical at first, the women tackled the job with a vigor, forcing them to change their tune in a hurry.

The tractor training course was divided up into eight lessons, with part of the instruction in classrooms, part in the field, and part in solo operation of tractors. Classes were broken up into small units so that each member could get as much individual instruction as possible.

They studied engines and transmissions, cooling systems and ignition. They learned to attach the major farm implements to tractors. And, they were taught not only the proper way to drive a tractor, but also the fundamentals of plowing, seeding, planting, cultivating and other tractor functions.

Safety was stressed in every lesson and one of the rigid requirements was that women be dressed in close-fitting overalls or slacks and shirt.

Many "graduates" of the course already are doing a man-sized job on their family farms, with the former cynical males occasionally getting pointers from wives or daughters on maintenance and safety methods.

The entire cost of the program was shared by the automotive company and its dealer body.

Industry Teamwork Accomplishes "Impossible" In Replacing Brass with Steel in Shell Cases

"THE DIFFICULT *we do immediately; the impossible takes a little longer.*"

This is the story of how the "impossible" task of substituting steel for brass in the manufacture of shell cases was accomplished when, in 1941, an alarming shortage of copper began to appear.

Though steel lacks most of the qualities needed for projectiles, U. S. Army Ordnance officers at that time summoned representatives of many companies with wide experience in making and treating and drawing steel to Frankford Arsenal to pool their "know-how" in an attempt to overcome the difficulties. Little success resulted from this initial conference; but the experts, returning to their shops and laboratories, carried back with them the challenge to attempt the impossible.

In an agricultural implement factory, one group of experts succeeded in making a shell case out of high-grade alloy steel, but this type of steel was becoming as scarce as copper and the manufacturing process was difficult and prohibitive in cost. Another group of experts of a steel company developed a chemically simple steel which, though it looked right, left the problem of drawing it into shell cases unsolved.

Concurrently, other groups were at work, in brass fabricating shops and in the factories whose peacetime products had been deep-drawn sheet-steel shapes such as automobile fenders, body panels, head lamps and similar units.

This experimental work, performed mainly on equipment that had been moved out of converted plants because it was not readily adaptable to war production requirements, resulted in several promising developments. One company, formerly a manufacturer of automobile head lamps, perfected a process whereby a "slug" of steel, resembling a hockey puck, could be shaped into a "cup" with a peculiar contour, so that the base would remain relatively thick while the walls were thinned into a long cylinder by successive draws on hydraulic presses. This process, shared by the companies working under the direction of the Ordnance Department's Steel Cartridge Case Industry Integrating Committee, was put into operation in several plants. And, within the surprising time of six months after the challenge was issued, a large segment of American industry was turning out steel cartridge cases by the millions for the smaller caliber weapons. Shell cases of 75 mm. caliber and larger were still troublesome, however.

Meantime, metal-working "know-how" acquired in years of manufacture of motor cars was concentrated on the larger calibers in an idle department of a former automobile factory. On ingeniously adapted equipment designed originally for the fabrication of automobile parts, techniques were perfected whereby the steel slugs could be hot-extruded at about 2,000 degrees F. into the first-stage cup and then drawn into a large-caliber case by a succession of cold-and-hot-working processes. This not only produced the desirable shape but put into the metal exactly that wide range of varying qualities required at different points of the finished product.

Although this record-breaking achievement of the "impossible" is a result of cooperative teamwork on the production front, the part played in it by the characteristically competitive habits of the participants is by no means an inconsiderable factor. For, although the several companies collaborated in the development, they clung to enough of their competitive traditions to remain contestants in the field of price. Hence, the armed forces are now getting streams of shells and cartridges in increasing quantities as a result of time-saving tricks competitively mastered, and at costs that have been reduced for the same reasons.

An unexpected dividend is that the substitute steel cases actually seem to be superior to the product which they are replacing. A recent Ordnance report indicates that the quality of the metal seems to improve with firing and that the cases may therefore be reloaded and used again and again.

With that report as a clue, one automotive company has just devised and put into operation testing equipment, which, simulating the effect of firing in a gun chamber, subjects the steel case to the stresses whicb seem to improve its quality. This company reports that no case thus tested has been rejected for physical failure.

WAR DELIVERIES RISE

Deliveries of war materials from plants of the automotive industry currently are running at an annual rate in excess of $8,400,000,000, it is shown in revised delivery figures for May.

During that month the armed forces received more than $700,000,000 worth of weapons. This was an increase of more than $25,000,000 over the previous month. June deliveries from automotive plants are expected to show an increase over May.

AUTOMOTIVE
WAR PRODUCTION

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Sicilian Invasion Proves Might of U. S. Production

Success of Operations Points to Value of Planned Work

DUE TO THE altered conditions, automotive exports to Sicily were not enthusiastically welcomed by some Europeans this year. They saw in the 14,000 American vehicles and 600 tanks and other products recently landed the menacing portents of competition with their home-made products.

While the length of time consumed in planning this mass-movement of American mass-produced equipment to Sicily was not fully appreciated at the time, the facts about it were dramatically presented several weeks ago.

One of the men chiefly responsible for the transportation feat, President Roosevelt, said:

"We cannot just pick up the telephone and order a new campaign to start the next week."

And many automotive industry workers, too, might have testified that they had begun working on military vehicles, tanks, guns, and planes many months in advance of their actual use.

The President's emphasis on the element of *time* involved in perfecting the campaign plans was particularly significant in the automotive factories, where the tradition of long and careful planning as a prelude to smoothly flowing operations is a venerable one.

A close parallel exists:

First, to comprehend the epic of the Sicilian landings, picture thousands of ships moving steadily across sea lanes, maintaining schedules calculated to put each contingent on a certain beach at a certain time.

Then, to get the second phase of the story, look behind the landing of the men, the equipment, the supplies at the point of attack.

Months before equipment could move up to embarkation ports there was split-second timing at the factories, with tons of raw materials flowing in one end and long lines of finished trucks and tanks rolling out the other. To casual visitors, amazed at seeing the clock-work precision of mass production, it appears almost magical.

But no magic wand waving is involved. Rather, it is work—hard work and detailed planning—based on immutable physical laws and the intricate details of mass production.

Said an automotive engineer, many months before the

blueprint of the invasion of Sicily was devised:

"You can't go out in the factory and TALK the machine tools into making war goods. You can't tell them to stop making this kind of *thing*—and start making this *other kind of thing*."

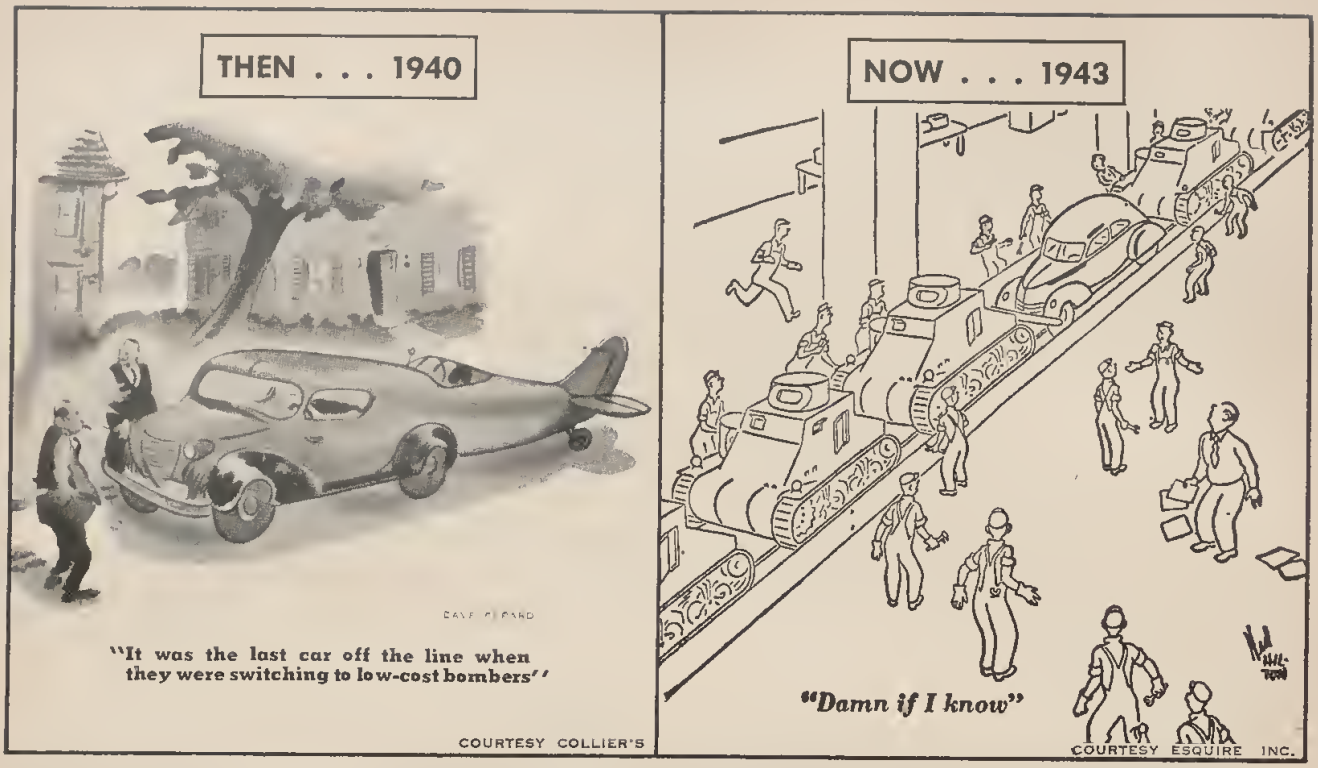
At that time—it was a few weeks after Pearl Harbor—the engineer was in the midst of transforming his automobile factories into munition plants, and in the process of retraining his workers to be war workers.

So far as personnel was concerned, a parallel problem was presented in the military training camps where men who had been civilians a short time before "learned how to perform the strange and difficult and dangerous tasks which were to meet them on the beaches and in the deserts and the mountains."

So, 18 months before the Axis defenses off southern Europe were penetrated, preparation was going forward for this job.

The engineers had to formulate production plans for

(*Continued* on *page* 3)



With humorous exaggeration, the cartoonists make even such difficult tasks as conversion look simple.

CIVILIAN OUTPUT REQUIRES MUCH PLANNING

Contemplated Truck Order Illustrates the Complexity of Converting Mass Production Facilities to New Jobs

HUZZAS and hosannas might have been expected from a group of manufacturers who had just been informed that the government was about to ask them to start turning out civilian stuff again.

Particularly so, when it appeared that civilian orders plus Army orders would give them one of their peak production years.

But paradoxically, the news of the impending orders that recently reached motor truck makers was serious news indeed, as it involved a tremendous new responsibility in tooling and preparation.

This was particularly so because the contemplated output involves a greater proportion of heavy trucks than the industry ever made, even in peacetime.

"What about recent let-ups in production of lighter Army trucks? Isn't it a simple matter to switch over to heavy trucks for civilians?"

The reasoning sounds logical, but . .

Converting quickly from lighter military vehicles to heavy trucks might be compared to trying overnight to change the style and form of a newspaper. Just as a publisher requires time to change his forms, adjust his presses, and arrange for other changes of detail, so a motor truck manufacturer needs time to reorganize for a product which is different in type and purpose.

The proposed Government program calling for heavy trucks for civilian uses comes right on the heels of Army orders for quantities of heavy trucks needed to maintain invasion supply lines. These "big bruisers" must be prepared to do the work of railroads bombed out of existence.

"CIVILIAN" PRODUCTION

"The longer the war goes on the clearer it becomes that no one can draw a blue pencil down the middle of a page and call one side 'the fighting front' and the other side 'the home front.' The two of them are inexorably tied together."

—President Roosevelt—

So to make heavy trucks in quantity requires a special tooling job—similar to that needed to make 30-ton tanks and other big military units in quantity.

This means further complications, for proper materials, tools and facilities must not only be planned for, but found.

In fact, the situation is remindful of the weeks immediately following Pearl Harbor when the Army was starved for equipment of all kinds. That resulted in a heavy load being placed on industry. Today, the coin is reversed. The lean and hungry look begins to appear on the civilian side.

So, another big job seems likely to be tossed on the automotive industry's shoulders, added to the huge volume of war work already being carried on. To lick the job means breaking bottlenecks in heavy transmissions, gears, bearings, forgings and castings.

To get the best results each manufacturer must be told how many trucks he is expected to produce, and when. Orders for future delivery must be given well enough in advance to allow for adequate forward planning. This becomes very important if specific production schedules for the year are to be met. Given time to prepare his facilities for a year of production to start on January 1, a producer makes one set of plans. But if he cannot get

going before June 30, then he requires either more facilities or more manpower, or perhaps more of both in order to make the year's production quota.

As was so forcefully dramatized at the time of Pearl Harbor, the mere appropriation of money doesn't mean weapons can be produced overnight, nor does the fact that there is a need for certain products mean they can be supplied until the producer knows what he is expected to produce and at what rate.

These facts must be decided so the manufacturer can set up the necessary facilities to do the job.

Whether a producer is to mass produce weapons of war or civilian trucks, he must have (1) blueprints and specifications, (2) a definite delivery schedule, (3) plant space available for manufacturing, (4) time to effect the transition from one type of production to another.

The fundamentals of mass production remain the same, whether the output is for peace or war. Experience with the civilian truck program may serve to emphasize that getting back into production on passenger cars and other civilian goods will require time—time to establish facilities, time to set up the productive equipment, time to organize the flow of materials necessary to sustain production.

The length of time required for the transition will depend to a large extent on how quickly plants are cleared of government-owned equipment and material, making room for machines that will make civilian products.

Sicilian Invasion Backed by Industry Output

(*Continued from page 1*)

radically new products. It was equivalent to starting a new business with new jigs—new fixtures—some new machine tools—and, in some cases, new buildings and entire new organizations.

Automotive plants were asked to make products subject to more severe stresses, strains and shocks than anything they ever built before. These products had to be finished more meticulously (93 operations on an aircraft connecting rod as against 25 on an automobile rod) and more closely inspected.

For upon these things depended the savings of lives and the successful taking of the beachheads in the months to come.

Then the products had to be made in QUANTITY. For the successful establishment of our forces on Sicily depended on General Forrest's famous principle: "Git thar fustest with the mostest."

Preparation for the campaign, therefore, could not proceed on the basis of tool room methods, which during peacetime were quite satisfactory for producing military equipment in small lot manufacture. Modern warfare demanded quantity production—MASS PRODUCTION.

The men of industry first translated detailed blueprints into hard, physical things. To make parts, they laid out row after row of special purpose equipment, forests of machine tools. They set in motion those flowing rivers of moving materials, the intricately connected assembly lines. They contracted for hundreds of parts to be made outside.

Months elapsed, in many cases, before the first trickle of parts and assemblies began to flow through some of the intricate systems. Then came finished products—a few at a time at first, then in volume.

In such quantities did they come that sea coast points, railroad sidings, and modification centers piled up with war products.

Puzzled at the accumulations, passers-by wondered whether someone had bungled in planning. "Where are we going to use all this stuff?" was a frequent question.

Then came the news—Sicily. Fourteen thousand vehicles were landed—a caravan 65 miles long if placed bumper to bumper—enough to cover 40 acres solidly if parked hub to hub.

"Do you realize what it is?" asked an on-the-spot observer, war correspondent Ernie Pyle.

"It is America's long awaited power of production finally rolling into far places where it must be to end the war. If you could be here and see it, you would understand how the might of material can overwhelm everything before it . . . "

"Where are we going to use all this stuff?"

How It's Done — No. 7 of a Series

PRECISION AND STANDARDIZATION

Automotive experience in developing interchongeoble ports provides a clue to the "mystery" of how unfomilior war products ore moss produced.

With precision built in machines, novices do work once requiring high skills.

TO ATTAIN unquestionable mastery of mass production two things have existed in Americans since America's beginning—the ability to shape hard physical things to such precise measurements that they are interchangeable under all conditions, and the ability to cooperate to such an extent that uniform standards of precision measurement in manufacture can be agreed upon and maintained

From the time Eli Whitney dumped a box of gun parts on the floor of a Washington office nearly 150 years ago and then amazed War Department officials by putting 10 perfect guns together from the pile, the principle of mass production was established From that beginning ingenious and enterprising Americans have been constantly striving always for greater exactitude in machining, greater precision in measurement, more and more standardization, more and more perfect interchangeability of parts

In 1906, Henry Martyn Leland, one of the motor car pioneers, took a leaf out of Eli Whitney's book when he sent a group of his engineers to England with crates of motor car parts for assembly before the startled eyes of members of the Royal Automobile Society Picking parts at random from the jumbled piles, the engineers assembled three automobiles which they then drove to victory in a contest for the Dewar Trophy

This demonstration proved to the skeptics that quality automobiles hitherto toolmakers' file-and fit creations, could be made in quantity

Though convinced of the necessity for interchangeable parts, each of the early motor car manufacturers built cars to standards peculiarly his own. Thus, by his own standards, his own factory's parts might be interchangeable, but since these early manufacturers were mainly assemblers of parts bought from other factories, interchangeability tended more and more to become a myth It was a myth too expensive to maintain Without agreement on standards, there was so much duplication of effort and waste of labor in the suppliers shops that the costs, passed on to the manufacturer and then to the public, tended to defeat the manufacturer's purpose increasing output at decreasing cost

To correct such conditions, the Society of Automobile Engineers was organized in 1906 Composed of engineering experts of the motor car industry it set out to establish standards of engineering practice in the industry Later it mapped out standards for parts and accessories specifications for materials and guides to follow in the acceptance or rejection of purchased parts or materials Its pioneering proved so valuable, not only to the automobile industry but to other and similar industries, that its name was changed to Society of Automotive Engineers

Under the aegis of the SAE even the most thorough-going individualists could cooperate Standards were adopted only after unanimous consent by all interested individuals The incentive was that constantly beckoning but never attainable goal still more output at still lower cost

As an example of how such standardization in the automotive industry redounded to the public's benefit, take rubber tires Before standards were agreed upon, there were scores of different types and sizes, all of them expensive because none of them could be made in quantities really great enough to bring about the desired reductions in price Today more then 80 per cent of the tires on the road are of one size They are interchangeable between different makes of cars They cost considerably less than their prototypes and they last longer.

The dollar value of such standardization to the public is incalculable Several years ago it was estimated that the automotive industry alone had thus saved the consumer about $840-million annually

The motor car manufacturers' pursuit of interchangeability of parts spurred machine tool builders to develop and improve precision instruments for industrial measurement The progress made in this field is shown by the fact that World War I was tooled up to tolerances of 1/1000th of an inch, while this war's accuracy demands are geared to 1/10 000th of an inch.

This, of course, means superior weapons for the United Nations from American factories It also means weapons in greater quantity

As an example of this industry's ability to mass-produce precision products take the automatic pilot, or "Iron Mike," used on U S bombing planes This complex instrument is so meticulously made of such precisely accurate parts that a pencil mark on one of its parts is enough to render its operation inaccurate Considered a watchmaker's product before Pearl Harbor, it is now being made in quantity in an automotive accessory company's plant and by women workers most of whom are industrial novices

In some quarters there were expressions of amazement recently, when several aircraft engines, made by an Eastern aircraft company and its licensee manufacturers in the automotive industry, were disassembled, scrambled reassembled with ease, and operated satisfactorily There was no occasion for the amazement As one veteran automotive engineer put it, 'Whenever high precision has been needed this industry has delivered the goods—with something to spare.'

Standardization, precision manufacture, parts interchangeability—these heve played a vital part in many an Allied victory so far in this war In those early months when "Too Little and Too Late" summarized defeat after defeat, the men on many a battlefront often held their wavering lines by 'cannibalization,' the makeshift practice of assembling usable parts from wrecked machines to build a 'new' machine General Chennault's "Flying Tigers" accounted for many Jap Zeros in such rebuilt fighter planes Marshal Rommel's "Afrika Korps" was held with such salvaged equipment

Recalling his experiences with the "Flying Tigers" in those days when all the ramming planes were "cannibalized' products, one engineer says—

"Every time this trick was pulled I said a little prayer for American standardization and interchangeability"

WAR PRODUCTION CONTINUES CLIMB

Sweeping steadily upward despite schedule changes the automotive industry's war production chart today stands at an all-time high level Monthly deliveries of war products at present are running in excess of $725,000,000, or at an annual rate of more than $8,700,000,000 One way of portraying this production, without revealing military secrets is to translate the dollar equivalents into specific products The data below, comparing June, 1943, with the corresponding month in 1942, show what the production would mean if concentrated in a few categories

The contrast would be even more striking if price reductions were considered

PRODUCT GROUPS	JUNE, 1942	JUNE, 1943
AIRCRAFT Aircraft, aircraft engines and parts at an annual rate of $3 225 000 000 or the equivalent of 1,250 Flying Fortresses A year ago annual output was equal to 3,670 Fortresses, each worth $350 000	Each symbol represents 1 000 Flying Fortresses	
TANKS Tanks, tank destroyers and parts at an annual rate of $1,320,000,000, or equivalent of 17,600 General Sherman medium tanks At this time last year, output was equal to 5,750 General Shermans	Each symbol repre[illegible] 1 00[illegible] General Sherman[illegible]	
VEHICLES Military vehicles and parts at an annual rate of $2,149 000,000, or representing enough money to purchase 2 390,000 jeeps Last year's output of military vehicles was equal to 1,930,000 jeeps	Each symbol represents 10 [illegible] jeeps	
GUNS Guns at an annual rate of $766 000,000, or the equivalent of $12,000 machine guns (50 caliber) Twelve months ago gun production was at an annual rate equal in value to 267,000 machine guns	Each [illegible]	
MARINE Marine equipment at an annual rate of $644,000,000, or the cost of 2 376 (PT) torpedo boats. This is almost double a year ago when marine output was equivalent to 1 280 torpedo boats	[illegible]	
AMMUNITION Ammunition at an annual rate of $150,000 000 or equivalent to 45,000,000 anti tank shells A year ago production of ammunition by automotive companies was at an annual rate equal to 21,700,000 shells	Each symbol represents 4 [illegible] anti tank shells	

Work here may mean difference between life and death on battlefronts

Voluntary Cooperation on U. S. War Production in Sharp Contrast to Nazis' "Cooperate or Else!"

Automotive technicians, once competitors, now cooperate.

To German Industrialists

Experience of arms factories must be pooled. A policy of keeping one's production methods secret will no longer be tolerated. I have ordered all war plants merged into rings so that every producer will obtain the benefit of the most efficient methods.

Herr Doktor Albert Speer,
Minister for Munitions and Armaments

February 11, 1943

THE ABOVE proclamation, issued 41 months after Germany entered the war, indicates that the Nazis are striving to achieve by coercion the kind of production which America is accomplishing by voluntary cooperation.

In bright contrast to the Nazi dictum is the fact that without benefit of orders or directive, the fruits of years of study and experimentation were pooled in the automotive industry within a few weeks after Pearl Harbor.

In less than three weeks, the one-time competitive companies in the industry had worked out a system to facilitate the sharing of their production secrets. Their technicians met at regular intervals to exchange ideas and demonstrate shortcuts, a practice which continues. Other industries, too, shared in the pool of "know how."

The cooperation has been real, as some of the little known stories, now coming to light, indicate.

An aircraft engine manufacturer needed two tons of large forging bars, calling for new and uncommon steel. Of two automotive companies that offered help, one could not provide the exact specification but something close to it. The second company had steel in stock which was "right on the nose" for specifications. This automotive company then capped its assistance by offering the aircraft firm the use of an electric furnace to make other experimental steels.

In another instance a Pawtucket, Rhode Island, manufacturer took on an order to produce fuse parts, but immediately encountered trouble with the automatic screw machines installed for the job. Lacking knowledge of the machines and the tools used in them, he appealed to the automotive industry for help when a half dozen experts had failed. One automotive company promptly freed its chief tool man from his job to tackle the problem. His only instructions were: "Take all the time you need to solve the problems." In three days the automotive expert had ironed out the difficulties, cut rejected parts to a minimum and put production up to par.

The grateful Rhode Island executive wrote: "The three days that Mr. M— spent with us did more to straighten out the difficult situation on our screw machines than any other action so far taken."

In the case of a late comer to the tank production field, the difficulty of drilling holes in an extra-hard type of armor plate presented itself. An automotive company, already in tank production, went to the firm's assistance, volunteering the information that it had adapted drills used on automotive crankshafts for this particular job. The company also supplied information on the speed and feed and coolant used in drilling armor plate, then dug up several samples for the newcomer in the fiield to study.

Pooled "know how" of formerly competitive companies has been one of the chief factors in the automotive industry's successful search for substitute materials to supplant those made critical by wartime shortages.

For example, take the small brake cylinder piston for military vehicles. Though many companies were experimenting with alternate materials for this item, little progress was made until the Pearl Harbor attack brought all companies together. The individual research on this project then was pooled, with the result that brake cylinder pistons soon were being made from new materials which satisfactorily replaced those formerly used.

AUTOMOTIVE WAR PRODUCTION

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HARRY A. WILLIAMS, Editor

New Center Building, Detroit, Michigan

War Veterans Discover Many Opportunities for Useful Work in Automotive Industry

Their war ends and jobs await them.

CLENCHING RIVET guns instead of Garands, operating drill presses instead of mortars, fox hole veterans are continuing to wage war against the Axis from industrial plants on the home front.

Mustered out of service because of disabilities ranging from severe shrapnel wounds to impaired vision, veterans of World War II are finding new careers in industry.

Knowledge gained over the years in employing handicapped civilians has provided automotive plants with valuable background in the placement of soldiers and sailors who have been rehabilitated for home front duties.

More than forty war veterans have been adapted so far to the work of a former automobile body manufacturing plant, now converted to war production. Among the new employes is a young seaman who was hospitalized for nearly eight months after his ship was torpedoed and sunk by the Japs near Midway Island. His job now is that of an inspector of aircraft parts.

Another newcomer is a veteran of several engagements in the South Pacific, who has recovered sufficiently from shell shock at the front to be able to operate a drill press in a quiet corner of the plant.

Trained for jobs entirely different from either peacetime or wartime pursuits, honorably discharged men are making good as production workers in various parts of the industry.

A Quartermaster Corps truck driver, who went safely through Guadalcanal only to be badly wounded at Darwin, Australia, is now recovered and is successfully running a turret lathe in one plant. A Chinese, formerly a washing machine operator, now rivets airplane fuselages in another.

Many veterans never had done industrial work before they received their present jobs. One who did, however, was promoted to a foreman's job shortly after he returned to his old place on the assembly line. His Army experience as a sergeant had given him considerable training in supervision of men.

At a plant where 18 veterans are now working, an interesting case is that of a soldier who received a spinal injury in action. Upon being mustered out, he found that the plastics field sorely needed the benefit of his experience. A graduate chemist, he is now an assistant in one company's plastics department.

Long before the war began, automotive companies successfully employed handicapped workers. Blind persons, for example, have proved superior in certain inspection jobs requiring a sensitive touch, one company's records show. Deafness is an asset in tasks requiring intense concentration.

In other instances, men lacking limbs are performing useful tasks with skill and competence. The employment of the aged, too, has worked out well.

Under wartime shortages, many employers are pioneering in this field, finding new ways to employ the so-called "unemployable," and setting the stage for the rehabilitation of war veterans.

Shake Hands with America, Sergeant!

Your Ship Was Built By a Big Team

EVEN WITH A political campaigner's hand-shaking ability, Sergeant Smith would have to start now and keep it up for the next couple of years to fulfill his wish.

For, when he received the Congressional Medal of Honor for saving the lives of a bomber's crew in combat, Sergeant Maynard H. Smith made the following wish:

"It was a miracle that the ship did not break in two. I wish that I could shake hands personally with the people who built her."

A diminutive and nimble man, Sgt. "Snuffy" Smith has a reputation of being "a little guy who gets around fast."*

Even so, he'd have to do a heap of traveling to clasp the hands of the thousands of persons from many cities and states who built the ship in which he served as a belly gunner.

For parts for the big B-17 flow constantly in and out of scores of former automotive plants, scattered up and down the Central States.

The very ball turrets of the type used by Sergeant "Snuffy" come from a former automobile body plant in Detroit, where hundreds of hands put together their parts drawn from scores of other plants. The guns are fashioned by many hands in any one of several automotive accessory plants in Saginaw, Lansing, Flint and Dayton, and in hundreds of smaller shops.

And duplicates of the engines that brought Sergeant "Snuffy" and his companions home in a battered and burning ship may come from automotive factories in South Bend, Fort Wayne and Chicago, and aviation factories in Patterson and Cincinnati.

Parts and sub-assemblies from all over the nation go to the Pacific coast aircraft plants for final assembly.

* * *

*Over St. Nazaire, Sgt. Smith climbed into the Flying Fortress' blazing fuselage, and by himself, put out the fire with extinguishers, water bottles and bare hands, meanwhile giving first aid to a wounded tail gunner, and pausing long enough to fight off Focke-Wulfs from several gun stations.

Materials, Machines from Automotive Lines Help Double Range of U. S. Fighter Planes

"Tojo's Teardrops" double their range.

ROARING high above the sea lanes, fleets of Lightning P-38 fighting planes today span the Atlantic and, setting down in England or Africa, continue to the military fronts.

That single-seat fighters have the range to fly from factory to combat theatres is due to reserve fuel tanks snuggled under their wings. When empty, the tanks are dropped from the planes during flight.

Preceding the roar of American fighters in these long flights over the Atlantic, however, was the clatter and clamor of automotive plants converting to war, some eighteen months ago. A policy was then established whereby idle equipment was made available to any manufacturer who needed it for war production. Under this "open door" policy more than 9,000 pieces of equipment were rapidly dispersed—presses to a Pennsylvania railroad shop making armored trains, welding equipment to Mississippi ship builders, machine tools to small firms throughout the Central states.

And on the Pacific coast one day arrived automotive equipment, salvaged from a storage yard of a former assembly plant, and automotive body steel rendered useless by the suspension of passenger car manufacture.

It had arrived because of an aviation engineer's idea that an ingenious use of automotive methods, machines and materials might do a job for the Air Corps, which then was cramped for cargo space to move fighters overseas.

To meet its need, the Air Corps had sought an auxiliary fuel tank to give fighter planes greater range—a tank cheap enough to drop when empty.

An aluminum tank had been offered—at a cost of $678 each. But with aluminum scarce and manpower on the West coast getting scarce, a product representing $678 in accumulated manpower and materials was deemed too expensive. Something cheaper was wanted, something capable of being mass produced, something using no critical materials.

At that point the aviation engineer got busy. In about the time your neighbor would devote to making a Victory garden look promising, he came up with a tank made of sheet steel, of the type which goes in automobile bodies. Weighing only 90 pounds, the tank was capable of carrying 165 gallons of gasoline. And the cost? Less than one-sixth the cost of the previous product, or under $100.

The engineer set up a moving assembly line, the foundation of which was 475 feet of a conveyor system obtained from an automotive plant when the industry's "come and get it" policy had been inaugurated. For material the engineer used S.A.E. No. 1010 automotive body steel, of which an abundance had piled up when car production halted after Pearl Harbor.

The streamlined tanks, called "Tear Drops for Tojo" by the aircraft workers who make them, are built by welding together two half shell stampings in a manner similar to that used in making fuel tanks for motor cars.

Hung from special fittings under the wings of fighters, the "Tear Drops for Tojo" provide the extra fuel capacity which enables these fighters to approach the range of big bombers. Flying the 8,000-mile route from factory to front, the planes not only speed to the places where they are needed, but also save valuable shipping space.

To augment the production of these ingeniously contrived time- and space-savers, the Navy has since called upon a former manufacturer of automobile bodies to make "Tear Drops for Tojo."

Harmony Not Only Barber Shop Product

TO THE imaginative mind mere physical resemblance of one object to another is often sufficient stimulus to a train of thought leading to an ingenious invention. Take, for example, the similarity of the pedestal mounts of the commonplace barber chair and the not-so-commonplace Oerlikon anti-aircraft cannon.

In a former automobile factory, in which conversion of facilities to gun manufacture posed unfamiliar problems, engineers, noting the resemblance of gun mount to barber chair pedestal, very naturally fell to wondering why the resemblance was only "skin-deep."

"Why should gears be used to raise and lower the gun?" they asked, "when the barber chair has the better principle of hydraulic controls?"

There being no satisfactory answer, these ingenious minds sought one in their own way; that is, they experimented. The result: perfection of a hydraulic mount which enables the gunner to raise and lower the gun with ease through the use of foot pedals instead of hand-operated wheels.

Tested at temperatures as low as 40 degrees below zero, this hydraulic mount works faster than the gear-operated mount under all conditions.

AUTOMOTIVE WAR PRODUCTION

Vol. II No. 9 | Published by Automotive Council for War Production | September, 1943

Automotive Economy Demonstrates Its Vitality

Industry Maintains Essential Services During Wartime, While Multiplying Munitions Output

WHILE not a single passenger car and only a small number of buses and trucks have been built in the past year and a half, the automotive industry still is a robust and dynamic influence on America's so-called "civilian" economy.

With the manufacturing branch so overwhelmingly concentrated on war production, the role of the "civilian" end has been somewhat obscured. YET:

It continues to pour millions of dollars monthly into federal, state and local exchequers. Last year this flow amounted to $2,034,748,000 in taxes.

Automobile dealers—87 out of every 100 of them—continue in business, servicing and maintaining the nation's rolling stock of cars and trucks.

Motor trucks continue to move nearly all of the nation's livestock from farm to dinner table.

Millions of workers continue to depend on their passenges cars to get to war plants.

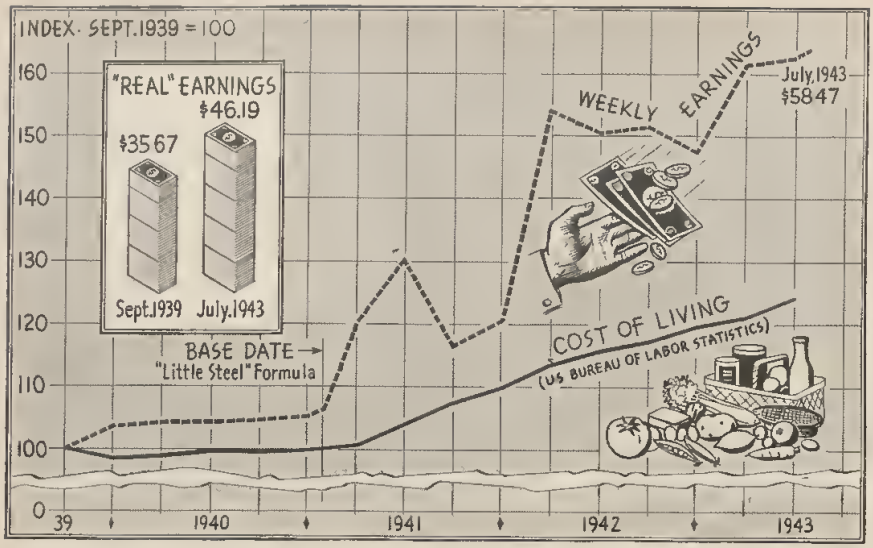
Nearly all businesses, in hamlet, town or metropolis, continue to depend on highway transportation for their commodities.

Truck transportation has meant that raw materials can be fabricated where power sites exist, rushed to spots where skilled labor is plentiful, then shipped over the highways to plants where specialized facilities are available for swift assembly in the shortest possible time.

The passenger car has helped bring about specialization in America, with men applying their talents to the jobs for which they were best suited. In peacetime, it meant that Texas sheep growers could exchange their mohair for Georgia's pine, that the Akron tire worker could send their products for Minnesota's wheat, that the Hartford parts makers could concentrate on their specialties and receive finished automobiles from Detroit or Flint or South Bend in return.

America's growing specialization was demonstrated in the automotive industry by the fact that while less than a

(Continued on Page 3)



Automotive Wages Rise to New Peak, Outdistancing Increase in Cost of Living

AUTOMOTIVE workers, long among the highest paid industrial employes in the nation, are continuing to hold their position in wartime despite increases in the cost of living.

Latest figures show that the average automotive worker is receiving a weekly paycheck of $58.47 cash. In terms of "real" earnings—dollar wages adjusted to changes in the cost of living—the weekly paycheck is worth $46.19. Both figures represent the highest peak in the history of the automotive industry.

Much of the increase during the war is, of course, due to the full utilization of automotive plants in the production of weapons, bringing about a longer work week with accompanying premium overtime payments. As a result weekly earnings of automotive workers have increased more than 60 per cent since the outbreak of war in September, 1939. On the other hand, however, hourly rates have expanded by 19 per cent in the same period, rising from an average of 92 cents an hour to $1.10 cents an hour in July, 1943.

Average weekly earnings of British war workers present a considerable contrast with those of American automotive employes. Men are paid on the average $22.78 per week; women, $11.72; girls, $6.42; boys, $9.02. In addition to the top bracket being less than half the $58.47 weekly wage in automotive plants, British wage practices also differ in that all U. S. automotive workers are paid the same rate, regardless of sex or age brackets.

According to a recent survey by the London Economist the bulk of Russian industrial workers earn about 300 rubles a month. Evaluated in terms of purchasing power, a kilogram of butter, which the U. S. worker buys for one hour of work, costs the average Russian worker 1/12 of his basic monthly pay in the controlled market, where prices are low, but goods are scarce.

The fact that "real" earnings in the automotive industry have advanced along with the increase in the paycheck is evidence that much more success in the fight against inflation is being achieved in the United States today than in World War I.

A picture of this is gleaned from the records of the Bureau of Labor Statistics which show the average automotive worker received $15.40 per week in his pre-war pay envelope. With the cost of living low at that time, his "real" earnings were equivalent to $21.91, in terms of present day values.

Though wages rose throughout the war period and reached a peak of $27.50 per week early in 1919, the average worker's standard of living remained at the pre-war status. For the runaway inflation of that time nullified his wage raises and, by the end of the war, his paycheck could buy only $21.83 worth of goods and services, or actually less than his $15.40 paycheck was worth in 1914.

Berlin's Joy Fades Under Idea Impact

Workers' Ideas Help Wreck Axis Planning

ONE of the most prized of all trophies being collected by the inveterate souvenir hunters of the U. S. armed forces in the Mediterranean theater is an Axis medal that unintentionally commemorates an Axis defeat.

Struck off at the order of Hitler to celebrate Marshal Rommel's fully expected triumphal entry into Alexandria, the medal is now a mere bauble, an ironic reminder of great expectations toppled into dusty defeat.

For the historic turn-about celebrated by that bauble, American workers will be entitled to much credit when the time for distributing credit arrives.

Perhaps thousands of American workers actually participated in that wrecking of Axis plans; for, in the automotive industry alone, hundreds of thousands of workers' suggestions have been contributed at an accelerating rate since Pearl Harbor.

At one automotive plant, for example, a total of 116,170 ideas have been submitted. To date nearly 20,000 have been accepted.

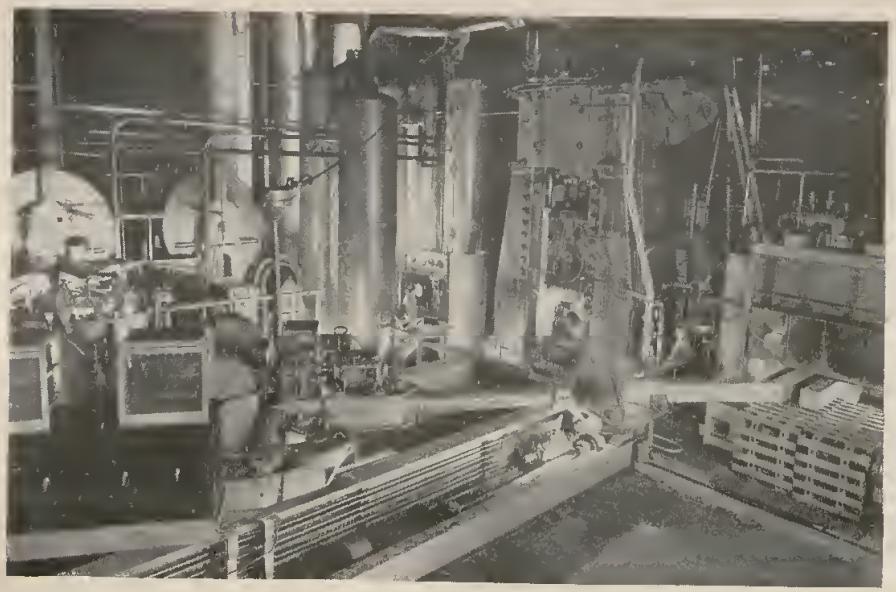
War bonds, ranging as high as $1,000 in value, are awarded for the ideas and $660,895 in war bonds at cash value have been paid out during the 15-month period. Cash payments currently are running better than $90,000 monthly.

Another automotive company has received more than 20,000 suggestions from its workers, with nearly one-third of those dealing with methods for boosting war production accepted and put into operation in the plant.

Since the inception of the WPB merit plan, workers of this firm have been carrying off top honors in the country. At the present time, 78 employes are holders of 80 awards.

Additional honors were recently heaped on the industry when, for the first time, WPB requested that a suggestion of two automotive workers be circulated among other industries.

The bright idea consisted of a chart and a set of tables showing machine settings for various radii in pattern work. It was considered of such merit that it could be used to advantage in the war work of shipbuilding, ordnance, aircraft and many other industries.



Technological Advances in Automotive Plants Help to Combat Growing Manpower Crisis

BATTLES are being fought behind factory walls today that will never be recounted under glowing place names like Pearl Harbor and Dunkirk, El Alamein and Wake Island. Yet these engagements on the production front are chalking up victories, important to the outcome of the war.

Historians might mark American industry's war record with such phrases as "the battle for conversion," "the breaching of the machine-tool bottlenecks," and "the conquest of critical material shortages."

"The struggle for manpower" can serve as the title of the current major engagement on the production front.

To meet and exceed output schedules, despite diminishing supplies of new workers and accelerated draining of established workers into the armed services, technological advances are being made throughout the industry. Ingenious methods and machines are being devised that not only release workers for other jobs, but they increase output and in many instances improve the product.

A new tire ring locking press, designed and built by one automotive company for military truck production, is a case in point.

With the press, a single workman centers the wheel, pulls a lever and four iron claws under 21 pounds of pressure are lowered to snap the ring into place. Previously, five workers with mallets drove the locking rings under the wheel rings. It is estimated that the press will save 2,500 man-days a year.

Rearrangement of equipment at a machine gun plant has enabled one man to operate a spline mill and three hand mills simultaneously. Production was increased 120 per cent and two men were released for other work.

An incalculable number of man-hours are saved by the recent installation of a 6,000,000 pound press at one automotive plant. An automatic manipulator with a one-man operator (see photo above) transfers 1,500 pound aluminum billets from furnace to press where greater strength is squeezed into them. The operator sits on the rotating turret section of the carrier and handles the job by merely operating six control levers.

Just as the cooperative approach has proved successful in meeting the other major problems of the wartime automotive industry, teamwork is expected to bring about quicker solutions to common manpower problems.

Sharing of ideas and research of engineers of formerly competitive automotive companies, for example, recently resulted in the development of a revolutionary process for finishing aircraft engine parts. Called shot-blasting (see pp. four and five), it eliminates vast hours of time spent in polishing parts and increases fatigue strength from four to tenfold.

Along with the savings of manpower and improvement of products, each one of the achievements of technology now in the service of war brings about a reduction in price of the finished product. Though unimportant in wartime, when saving of lives is the only yardstick, such economy advances will be highly significant when they can be applied to the products of peace.

For, as the automotive industry has proved in its tremendous growth over the past 40 years, by bringing price down, a greater demand for the product is created. Greater demand means more production, with a subsequent increase in employment.

Industry's Economic Value

(Continued from Page 1)

half million workers were engaged in manufacturing motor vehicles before the war, the total employment generated by automotive activity exceeded 6,000,000,000 jobs.

Within the orbit of the automotive industry were developed great facilities which concentrated on making axles, wheels, bearings and other such units making up an assembled car or truck. Through such specialization, the American automotive industry was able to pay high wages to its employes, top prices for its materials, and yet produce motor vehicles at a price and quality no other nation could meet.

Today, the automotive industry's great manufacturing facilities, developed under a competitive economy, are roaring mightily with war work. The plants of this one industry are producing munitions at an annual rate of nearly $10,000,000,000, or two times the highest level ever attained in peacetime.

As in peacetime, the automotive industry's capacity for employment is by no means confined to its own factories. The industry's war work is shared by subcontractors and suppliers in 1,375 communities in 44 states, with 56 cents of every dollar received going to these smaller firms. More than 60 per cent employ less than 500 workers each.

Though the exigencies of war have choked off many avenues for profitable employment (tourist sites, roadside restaurants, countryside taverns, rural markets, etc.) which resulted from widespread use of motor vehicles in America, these and other newer means of employment can be expected to spring up when the war ends and the insatiable restlessness of the American people seeks its outlets.

Tedious finishing process telescoped by new automotive technique

How It's Done — No. 8 of a Series

AMERICAN INGENUITY

Relentless drive for convenience and comfort, a contributing factor in the peacetime growth of the automotive industry, is helping to provide more and better weapons for the Allies.

A FAMOUS critic once observed that "it is a special talent of the German mind to make no mistakes except the very biggest."

Classic example of German misunderstanding of American character is the historic letter which, written by a German agent to his Berlin superiors just prior to U. S. entry into World War I, confidently predicted easy defeat of the U. S. because of "the conflicting selfishness of American business."

Although Paul Von Hindenburg underscored that error as a cause of German defeat when he later wrote his memoirs, his Nazi successors persisted in the habit of making no mistakes except big ones. This time, the German lack of psychological sensitivity, duly aped by the Japanese, summed itself up in the expression:

"Americans are soft."

To assume that Americans can be easily defeated because they are lazy and soft is to misinterpret the well-known fact that the average American, if allowed free play for his inherent inventiveness, habitually finds the shortest and most direct route to a condition of ease and comfort through the development of some labor-saving technique.

Realistic interpretation of this fact has in large measure been responsible for the phenomenal growth of the American automotive industry. In the busy shops of this industry hundreds of products and processes, inaugurated in peacetime to save labor or augment comfort, are now working for the discomfort of the nation's enemies.

For example, there is the process called "superfinish," a metal-polishing technique which, developed originally to eliminate an annoying buzz in automobile axles, is now being applied to the manufacture of non-shatterable reflectors for searchlights. This process, perfected with the intent of catering to the American desire for comfort, now contributes much to the enemy's discomfort in night battle actions.

Similarly, such recently developed contributions to motoring ease as hydraulic transmissions and automatic gear shifting devices, adapted for use in combat vehicles, have increased the maneuverability and effectiveness of our motorized forces.

But one of the most dramatic of such examples is the story of how a labor-saving method of cleaning steel for automobile springs became a metal-toughening process which promises to multiply aircraft engine production at a time when such increase is most needed.

The story begins on a cold and blustery January afternoon this year. In the conference room of an automotive factory now engaged in manufacturing aircraft engines, a score of formerly competitive production experts sat down around a table to "talk shop."

On this afternoon two serious and seemingly conflicting problems confronted them. All aircraft schedules had just been doubled. This meant that work in their engine factories would have to increase. At the same time the manpower demands of the armed forces were beginning to cut deeply into working personnel. Gloomily they asked, "How are we going to double output with dwindling staffs of workers?"

At that juncture a veteran of an "old-line" aircraft firm tossed a beautifully polished connecting rod on the table and said:

"I'd like to hear some straight-from-the-shoulder opinions about the amount of time we consume in dolling up and fussing with engine parts. Is it really necessary to make these things shine like jewelry, or are we frittering away precious time from force of habit?"

This call for a frank discussion quickly brought into the open a wealth of ideas which the automotive production experts had about methods which, common in motor car manufacture, might be tried on aircraft engine parts. Among these ideas were proposals to try shaving instead of grinding to the fabrication of gears and tumbling instead of filing in the finishing of certain other parts. But the alternate process about the virtues of which most of them were most convinced was the metal-finishing technique called "shotblasting" which they almost unanimously recommended for consideration as a possible substitute for the laborious and time-consuming practice of polishing all engine part surfaces to near-mirror smoothness by hand.

In non-technical terms, shotblasting is a method whereby the surfaces of machined metal parts are toughened by bombarding them with steel shrapnel for carefully controlled periods of time. Long familiar to automotive industry technicians, it has been chiefly used to strengthen such dynamically loaded parts as leaf and coil springs for axle suspension and to lengthen the life of highly stressed valve springs.

Its use as a means of improving the fatigue resistance of steel is said to have suggested itself when the curiosity of an automotive parts company's inspectors was aroused by the fact that spring steel that had been cleaned by sandblasting seemed to be tougher than steel that had not been cleaned.

Similar observations, recorded in a British technical paper in 1927, prompted further investigation of the phenomenon by automotive engineers and the first production springs, shotblasted to increase fatigue limits, were employed in 1929. The technique was progressively improved thereafter and its field of application was enlarged. When motorization of the U. S. Army was expanded, shotblasting was applied to tank parts with encouraging results.

In November, 1942, an automotive company's laboratory issued a report upon the subject which, based on exhaustive research, provided the first method of measuring the extent to which shotblasting could be used without damaging the object being blasted.

Provided with methods for gaging the effect of the blasts, automotive men began to experiment on aircraft engine parts. Using parts rejected by inspectors, they blasted and tested and compared results.

What they were hoping to accomplish was the possibility of shortening the tedious sequence of machine operations on aircraft parts. For the traditional practice in making such parts is to forge, rough machine, rough grind, heat treat and finish grind them and then polish and buff all their surfaces, with several magnaflux inspections included in the sequence.

Reason for such meticulous procedure is the necessity to remove even the most minute surface scratches lest they, like the scratched line of a glazier's tool on a pane of glass, become the focal point of breaks under the stresses of vibration.

In their testing of discarded parts after shotblasting the experimenters discovered evidence that these parts, like automotive springs, were strengthened in the process. One company, manufacturing an aviation engine of its own design, obtained permission to shotblast connecting rods. In addition to saving 36 man-hours per engine plus considerable

(*Continued on Page 6*)

The result: more and better warplanes to fighting fronts in less time.

Blasting with shot also strengthens vital parts of aircraft engines.

Motor Vehicles Are Proving Valuable Ally In Wartime Functions of American Red Cross

As in every war since its formation in Switzerland in 1864, the International Red Cross has been in the forefront of the effort to save lives and give solace to the suffering. In this war, it has a valuable and effective ally—the motor vehicle.

Though overshadowed by weapons of destruction rolling off assembly lines, motorized units are widening the scope and increasing the flexibility of modern humanitarian endeavors.

Currently, the American Red Cross utilizes dozens of mobile units to aid in blood plasma collections. Paying regular visits to points within a 50-mile radius of blood-collecting centers, these special motor vehicles enable many additional donors to contribute to the Army and Navy plasma bank.

In addition, station wagons and passenger cars transport technical staffs engaged in this blood bank work, while refrigerated trucks are used to rush the donations to laboratories within 24 hours after being drawn.

Motorized units are helping to maintain morale of soldiers abroad. Making the rounds of camps in North Africa, the British Isles and other centers are "clubmobiles", a term applied to standard Army trucks manned by Red Cross workers. When the clubmobiles arrive at a camp, soldiers gather about for doughnuts, coffee, cigarettes and chewing gum and to hear the musical entertainment.

In England, buses have been converted into ambulances, capable of carrying 12 stretcher cases, and into clubmobiles used to transport Red Cross shows and revues from camp to camp.

Clubmobiles currently are being placed in service in Alaska and on the Alcan Highway, where they carry motion picture projectors and screens to lonely camps. The vehicles can be transformed into ambulances within a few minutes.

Motor vehicles are not only helping the Red Cross to carry on its mercy work, but they are functioning with the troops on all fronts, saving countless lives of wounded soldiers.

In the recent battle of Sicily, nineteen ambulance jeeps were with the Canadian troops throughout the entire campaign. Operating over almost impassable terrain, they brought back in one or two hours casualties that would have taken seven or eight hours under the old hand-stretcher method. In one dramatic incident a soldier was on the operating table fifteen minutes after falling to the ground with a gaping chest wound. Ten minutes later, a successful operation had been performed and the soldier was on his way to a hospital ward.

Women "Tinkerers" Speed War Output

Prove Ingenuity Is No Male Monopoly

Yankee ingenuity, traditionally regarded as masculine, turns out to have been latent in female brain cells all along.

Enthusiastic tinkerers who a short while back ran for the man of the house when the bathroom spigot leaked or a nail in the kitchen needed hammering, now not only take the manipulation of intricate machinery gracefully in their stride but manage to come up with a host of new inventions and gadgets as they go along.

One plant recently reported that the first two certificates for individual production merit awarded its employees by the War Production Board have gone to women.

One of these awards was for devising a pencil-like tool which neatly picks up small rivet washers, eliminating the tedious job of picking them up by hand. The young aircraft worker who submitted the suggestion was able to boost production of a small assembly by 120 pieces an hour. She saved 18 hours of production time a day.

The other worker to be cited was the inventor of an ingenious arrangement for telescoping a three-step job into a single operation. Her output and that of other workers on the same job thereby increased 45 per cent.

American Ingenuity

(*Continued from Page 5*)

floor space and polishing equipment, the change-over resulted in vast improvement of the product. Applied to crankshafts by the same company, the process resulted in from fourfold to tenfold increase in fatigue life.

Another company, having proved advantages of the process on parts of a marine engine, got approval for its use on parts of an aircraft engine.

The interest of Army and Navy officers has now been aroused because the technique shows promise of not only great improvement in the strength of aircraft engine parts but also of potential increase in the life expectancy of the average engine.

The change in technique is proceeding slowly, with ample opportunity for test and re-test, for the lives of airmen depend on the results.

Provisions in Plants for Physical Differences Enable Women to Handle Variety of War Jobs

THE discovery that woman isn't just a "smaller man" has had a profound effect on production engineers in the automotive industry's war plants, and is resulting in adaptations of plant equipment that are greatly increasing output of weapons.

That the skeletal and muscular structure of the average woman shows a host of differences other than mere size from that of the average man is a fact long recognized by those branches of the industry where women traditionally had been employed.

Productive know-how, on this as on many other things, has spread throughout the industry under the wartime policy of mutual sharing. With the total number of women employed in automotive plants up 300 per cent, the experiences of the veteran employers of women is of incalculable value.

For instance, there is the matter of woman's shorter arm reach, which, combined with her shorter average stature, necessitates lower work benches with narrower tops.

Compensations in production processes must be made to allow for the fact that the average woman is only 35 per cent muscle in comparison to the average man's 41 per cent. Moreover, industrial studies have shown that only 54 per cent of woman's weight is strength, as against man's 87 per cent, and that the hand squeeze of the average woman exerts only 48 pounds of pressure, against man's 81 pounds.

To adjust women's jobs to such differences, automotive plants have added more mechanical aids such as conveyors, chain hoists and load lifters.

In tasks requiring exceptional manual dexterity or concentrated attention upon meticulous details, women invariably excel men.

This superior dexterity shows up in even the heavier tasks when mechanical adjustments are made for their inferior strength. For example, take the twelve women who recently invaded that hitherto exclusively masculine province, the automotive foundry.

Supplemented by weight-lifting mechanisms, these feminine moulders not only quickly reached a production output of from 80 to 100 moulds—just under the average for men—but produced less scrap than the men.

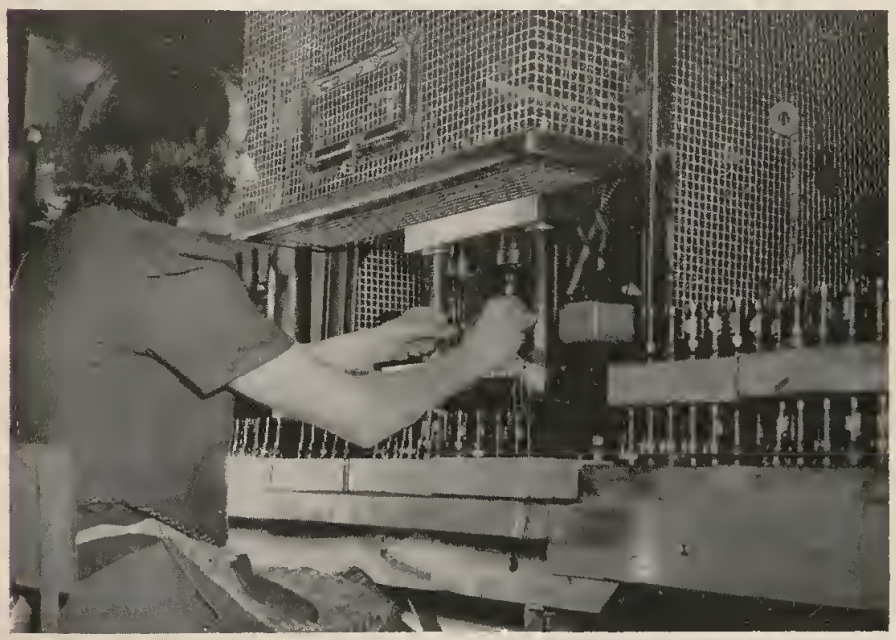
At another automotive plant, women replaced men effectively as riveters of aircraft wings when revolving jigs were devised and installed to facilitate rotation of the heavy and bulky wing sections.

Huge presses, formerly used to form automobile parts, are now doing war work with women as their operators. In adapting these giant presses for their new operators, safety devices of the kind long used on punch presses operated by women in automobile parts plants have been employed.

Extensive use of automatic lift trucks has enabled women to serve as stock handlers in several plants, and the sight of women crane operators has become quite commonplace.

Women are driving heavy trucks. They are working on drafting boards in tool designing departments. They are sharpening cutting tools. In one of the first instances of its kind in industrial history, a woman has taken over as plant doctor at an aircraft division of an automotive company. In several other former automotive plants women, trained in the art of jiu-jitsu and the use of firearms, have been added to plant protection forces.

Designed for women, difficult tasks become easy.



AUTOMOTIVE WAR PRODUCTION

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HARRY A. WILLIAMS, Editor

New Center Building, Detroit, Michigan

Production of Mosquito Bombers Revives Skill of Veteran Automotive Woodworkers

SHELVED when steel replaced wood in automobile bodies, the skill of the woodworker is once more in demand as war needs call for the use of wood in bombers, gliders, trucks and other military supplies.

In the Canadian plant of one automotive manufacturer, for example, a number of 30-year veterans of the old carriage-making days are again plying their art, helping to produce the famous Mosquito bombers.

Composed almost entirely of wood, the Mosquito, with its tremendous speed, has been chalking up an outstanding record in unescorted sorties over Axis-held territory. Recently Mosquitos have been harassing the enemy with hit-and-run bombing attacks on Berlin.

The fuselage of the Mosquito is much like an American three-decker sandwich, with wood and milk products as the ingredients. The inner-layer of three-ply birch is first laid over a solid concrete mould in which there are indentations holding the cross members in place. The first layer is "buttered" with a plastic casein glue, made principally from milk. A second layer of balsa wood forms the "meat" of the sandwich. This is again "buttered" on the outside before the third layer of plywood is applied to complete the job. Fuselages are constructed in two complete halves and then joined together.

The wood craftsman originally worked for one of the early carriage makers who, about thirty years ago, turned to the manufacture of automobiles. Since skilled hands were needed in wooden bodies, they continued to work at their trade until the introduction of the all-steel body. Most of the woodworkers then were transferred to welding and metal finishing jobs.

When the order for Mosquito bombers was received by the automotive company, at least half of the available personnel was made up of men from the old carriage and wood composite body plant. Much of the success in fulfilling this contract is due to their specialized experience and know-how, the company reports.

Though frowned upon by many aircraft experts when it was first conceived because of its wood composition, the Mosquito bomber has proved itself in battle, playing several major and distinctly different roles in the joint R.A.F.-U.S.A.A.F. hammer blows at the Axis. Instead of a detriment, the use of wood has turned out to be an asset. Not only is its extreme lightness an advantage, but a bullet will not splinter the fuselage nor will it mushroom and leave a gaping hole on the way out. Highly compressed wood limits the possibilities of burning.

Automotive Engines Fight on All Fronts

Many Allied Planes Rely on U. S. Power

NOT ALL the horsepower for airpower now emanating from engine-building lines of the automotive industry is used by the U. S. aerial warfare services.

Much of it powers Great Britain's combat aircraft. Some of it harries the Nazis along the 1,500 mile Russian front, with the capable hands of Red Army pilots at the controls.

In the Mediterranean and European theaters, winged horses born in the automotive industry's plants roar defiance at the Axis in the hands of many nationalities—free and Fighting French, Norwegian, Dutch, Belgian, Greek, Polish, Czech and others who fight for the return of freedom to their lost homelands.

On the Asiatic fronts, some of these nationals plus the Chinese strike aerial blows in aircraft powered with engines from automotive plants.

Though it is a British product, the Mosquito bomber gets its power from a former automobile factory in Detroit, as do the RAF's four-engined Halifax and Lancaster bombers, and the Boulton-Paul two-place, Hurricane and Spitfire fighters.

Veteran automotive woodworkers "at home" building Mosquito bombers.

AUTOMOTIVE

WAR PRODUCTION

Vol. II No. 10 Published by Automotive Council for War Production October, 1943

Industry's Volume Rises While Unit Costs Decline

Better Products at Lower Prices Result of Efficient Methods

THE BIG PARADE of war production streaming from automotive war plants is now at the $10,000,000,000 a year mark, representing almost endless columns of guns, tanks, shells, aircraft and motorized equipment pushing toward the battlefronts.

If a yardstick were used showing physical volume of war production, rather than dollar volume, the parade would be even more impressive.

For the dollar volume measure makes no allowance for lowered costs of war products which have been achieved by efficient mass production methods. It does not reflect the armored divisions, the motorized corps, the acres of aircraft equipment which have, in effect, been given *free of charge* to the armed services.

While no exact figures exist for the automotive industry as a whole, the savings to the government resulting from manufacturing efficiencies, price reductions and voluntary refunds amount to several billions of dollars.

The steady decline in the price of war items effected by the automotive and other industries stands out sharply against a trend of rising costs, and rising prices of non-war items.

Searching for methods to increase output and improve products is long-standing practice in the highly competitive automotive industry. Since the beginning of the war effort, master mechanics and production engineers have continued to develop countless new techniques for turning out better products faster and at lowered costs. In terms of physical volume, the billion a month annual rate of production predicted for the automotive industry by Donald Nelson is believed to be already achieved.

After getting the feel of production on new and unfamiliar items, automotive engineers have been able to clean up the bottlenecks, smooth out the rough spots, and work out short cuts. With a sustained volume, slashing of initial costs resulted, even in the face of higher wage and material costs.

Instances abound in the automotive industry where prices of war products have been lowered. Here are a few:

On an aircraft cannon, gun carriage and gun mount, one company has been able to effect price reductions totaling $16,000,000. Three reductions have been made on the gun

mount, three on the cannon and one on the gun carriage.

Marine engines for the Navy's torpedo boats and aircraft engines for British and American fighters and bombers are rolling off another company's assembly lines under an overall price cut of 18 per cent.

Improvement in nearly half the production steps in the manufacture of Oerlikon anti-aircraft guns has enabled another automotive firm to reduce cost by 50 per cent.

Through the adaptation of the automotive conveyor line technique for the production of wings for P-47 Thunderbolts and Flying Fortresses, a former body manufacturer has been able to cut prices by 37 per cent.

Still another company, producing several major aircraft and ordnance items, has been able to save many millions of dollars of the taxpayers' money. On one unit alone, this amounted to more than $10,000,000.

Improved manufacturing practices also are paying off in another important respect—they are cutting down on manpower requirements at a time when the manpower shortages threaten to become the limiting factor upon production.

"Ingenuity in new tooling" was cited by a top Air Corps

(Continued on Page 3)

Trucks and guns now roll to the front with o minimum of critical moteriols.

Automotive "Know-how" Helps Avert Disaster By Easing Drain on Supply of Metal Alloys

IN a Washington, D. C., conference room, shortly after Pearl Harbor, a group of men helped avert black disaster brought on by America's diminishing supply of critical materials.

This group, a cross-section of the Nation's best metallurgists, included men skilled in the many branches of metallurgical science. Steel specialists, their combined lore embraced extraction from ores, refining, alloying, shaping, treating and the knowledge of the structure, composition and properties of the ferrous metals.

With the enemy in control of many sources of precious alloys, these metallurgists drastically reversed a trend in American industry's metal working practices. In effect, they pushed down the high alloy content of steels and still made the metals do the jobs they had to do.

It is now apparent that the result of these efforts twenty-two months ago had in effect created reserve stocks of chromium, nickel, manganese, molybdenum and other scarce metals.

Out of that conference the now famous "National Emergency" steels were born—but born in name only.

For the program they had initiated, then submitted for analysis and criticism to users like the automotive metallurgists who had pioneered in peacetime conservation of alloys, finally developed into the present "NE" steel setup.

The combined efforts of all groups brought about drastic reductions in the use of critical materials on scores of war products. A M-4 tank, for example, now consumes only 25% of the alloys needed for its production early in the war.

Among the group that put the "NE" steels into use were a number of metallurgists, men who knew from peacetime experience how to make automotive materials of low alloy content come through with results equal to high alloy steels. Their knowledge of the subject embraced such essentials of the metal-working arts as forging, heat-treating and machining techniques —all vital factors in the proposed changes.

In combatting axle shaft failure in motor vehicles through the twenties and in seeking other product improvements, automobile manufacturers had been big users of expensive alloys to give hardness and toughness to heavy duty parts. Within a few years the automotive industry became a foremost market for high-alloy metals.

Then, like the night club visitor who tips the head waiter $15 for a front row seat, only to discover that $2 is sufficient for the same accommodations, the automotive metallurgists found that they could get as effective metallurgical results without overdoing the alloy contents.

The secret was tailoring the steel to the measure of the particular part in mind. With proper controls in the metal-working processes, for example, low-alloy steel for ring gears or pinions would serve just as well as parts burdened with expensive alloys.

Working in this then undramatic field, automotive metallurgists and production men quietly effected improvements in production quality, at reduced costs, during the thirties and the economies were passed on to the consumer in improved models.

In making plans for its 1937 model, for example, one passenger car company gave thorough working tests to a rear axle ring gear. Before adopting a low alloy steel for the unit, the manufacturer ran 5,000 sets of gears through on a production basis to obtain final machining costs and to determine the necessary heat treating cycle required.

Encouraged by the findings, the company then embarked on experiments with three other steels for differential gears, and four alloy steels for transmission gears.

(Continued on Page 3)

Conserving Critical Materials

Recommendations of automotive engineers result in huge savings of nickel, chromium and molybdenum in 1943 production of tanks, trucks and tank destroyers. Figures are based on production estimates for 1943 by U. S. Army, Ordnance Department.

ITEM	Nickel	Chromium	Molybdenum
Medium Tank, M4	3,938,000	2,097,000	591,000
Light Tank, M3	240,000	293,000	94,000
Light Tank, M5	293,000	346,000	113,000
Half Tracks, M2, M3, M5 and M9	50,000	18,000	24,000
3" Gun Motor Carriage, M10	985,000	545,000	160,000
75 mm Howitzer Gun Motor Carriage, M8	94,000	133,000	18,000
TOTAL	5,600,000 lbs.	3,432,000 lbs.	1,000,000 lbs.

"$100 Per Man"

"In the former automobile plants, now converted to war production, 87.6 per cent of all the workers are regularly buying bonds on payroll deduction plans, and those who are enrolled are regularly investing 10.3 per cent of their wages.

"During the Third War Loan drive the workers in representative automobile plants in Detroit invested upwards of an average of $100 a man in extra war bonds. They did this of their own free will, without compulsion by the Government."

Henry Morgenthau, Jr.,
Secretary of the Treasury

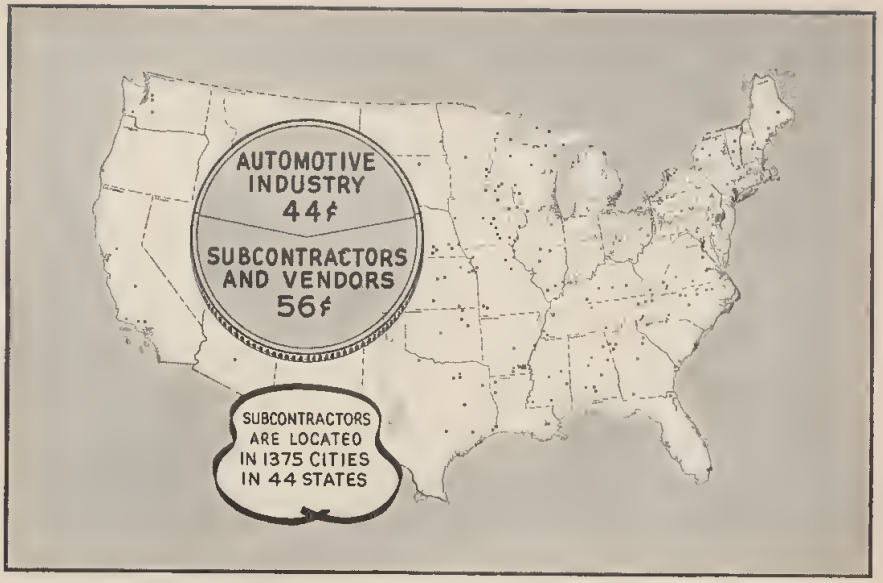
Saving Materials

(Continued from Page 2)

In the months preceding Pearl Harbor, metallurgical and research departments throughout the industry stepped up their efforts to find alternate materials for those which were growing short. Long before some of the material shortages were generally felt, automotive companies had hit upon so-called "substitutes," materials which by production tests proved their ability to hold up.

It was found that steels could be "needled" with special addition agents which condition steels. Such ingredients need be used only in minute quantities to increase hardenability and other desired properties.

This vast background of experience, documented with tests from laboratories throughout the automotive industry, stood behind members of the Society of Automotive Engineers and its War Engineering Board Committees, the chief groups which have been dealing with steel substitutions. From their well-thumbed notebooks came much of the information that resulted in substitution of "NE" steel formulas which, in turn, were taken up by all America's war industries. An era of "new" steels was launched to put America's vast war program on the rails.



Nationwide Subcontractors, Suppliers Account For 56 Per Cent of Automotive War Job

A TOTAL of 56 cents out of every dollar received by the automotive industry for war work is paid out to subcontractors and suppliers, it is shown in a recent survey of the industry.

As the armed forces have constantly increased production schedules of weapons, the industry intensified its long-standing pattern of subcontracting to accomplish the huge tasks.

Factory expediters were sent out "ringing door bells," scouring the nation to find industrial establishments, sufficiently equipped and sufficiently manned, to make the bits and pieces that, assembled all together, composed the complete guns, tanks or planes.

The work of suppliers is reflected in the latest production figures of the automotive industry, which show that: Aircraft production is 185 per cent greater than the corresponding period last year. Tank output is up 80 per cent, military vehicles, 34 per cent, and guns, 90 per cent.

While the automotive industry is mostly identified with the Middle West, virtually the entire nation contributes to the automotive war job. Suppliers and subcontractors, for example, are located in 1,375 cities in 44 states. For the most part, these concerns are classified as small business, 63 per cent employing less than 500 workers each.

The parts industry alone, for example, has plants spread over 42 states and hundreds of cities in the nation. These specialists, who in peacetime supply such products as axles, bodies, transmissions, valves and pistons, are such an integral part of the automotive industry that the speed of post-war reconversion will depend to a large degree on how quickly they can begin supplying their specialties with the return of peace.

Price Reductions

(Continued from Page 1)

officer, Brig. Gen. K. B. Wolfe, as the element which would lick the manpower problem in meeting increased aircraft production schedules.

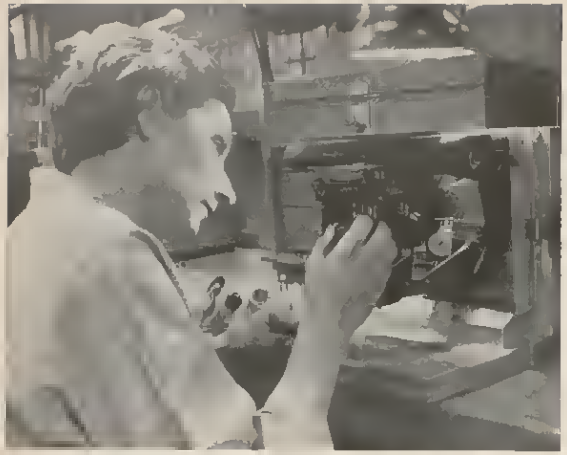
"You've got a tough assignment ahead," he said, "but it's an old story in automobile building. Ingenuity in new tooling will get out the production with the manpower at hand."

Despite the fact that price reductions tend to distort the true picture of physical output, the automotive industry's war effort is of record proportion, even when measuring by dollar volume.

Currently the industry is producing war materials two-and-a-half times in excess of its best peacetime rate. Production in the first seven months of 1943 was more than the output for the entire year of 1942.

ENGINEERS OF WOMANPOWER

Housewives are "different" but management is displaying ingenuity in fitting them into war production jobs.



Nimble fingers of women prove adept in handling delicate war jobs.

IF, AFTER A FULL DAY in the plant a husky male worker washed the week's linens, put supper on the stove scrubbed the children and put them to bed, then settled down to an evening of darning socks, he could easily win a "Believe-it-or-not" contest in most any community

Yet, the above routine is all in a day's work for numerous woman workers Even after an eight or nine-hour stretch on the war production line, the home responsibilities call for continued efforts when the feminine wage earner is "off duty"

This is one of the hard, real facts about womanpower that automotive plants faced in replacing drafted men with new workers from the home Like the conversion of plants and machinery to war production, this transition to a "different" type of personnel demanded real engineering skill

"Industry has prepared for women and made the way as smooth as possible," said the regional director of the War Manpower Commission recently, in a community that is predominantly automotive

In tackling the problem, however, it was necessary to do much more than break down and simplify operations so they could be learned by women in the shortest possible time

This was a physical job, and could be done by remodeling work tables to accommodate the shorter arm length of women by installing roller conveyors and overhead pulleys, and by other such adjustments to reduce fatigue and relieve strain

The perplexing problem resulted from the fact that the woman worker is "different," psychologically, emotionally and in her social functions

It was realized that womanpower differs from manpower as oil fuel differs from coal, and an understanding of the characteristics of the energy involved was needed for obtaining best results In automotive war plants many mechanical operations had never been attempted by women before, and female capabilities for handling such work were generally unknown This situation has been met by induction tests that rated the women in respect to their mechanical aptitude, and thus made it possible to train them and fit them accurately into jobs.

Some of the plants have hed screening tests set up for them by psychologists- Their purpose is to rate the woman's general intelligence, her mechanical and manipulative ability, and her emotional reactions, or self-control

Often she is asked to perform a very simple exercise such as fitting together the parts of a jig-saw puzzle, to determine the way she uses her hands A personal interview by a trained personnal man will serve to bring out her leadership qualities, her emotional balance, and perhaps to determine whether she may some day be moved up the line to take charge of a group of women workers-

The purpose of these tests, in this time of manpower shortage, is not to eliminate job applicants, but to utilize each newcomer in the spot where she can serve best

On certain kinds of operations—the very ones requiring high manipulative skill—women were found to be a whole lot quicker and more efficient then men Not surprised by this, one plant manager observed "Why should men, who from childhood on never so much as sewed on buttons, be expected to handle delicate instruments better than women who have plied embroidery needles, knitting needles and darning needles all their lives?"

Even in competition with men workers new women took over most of the delicate precision jobs In one automotive shop a crew of girls was assigned to the job of passing or rejecting the crankshafts for motors that go into P-38's and other types of fighting planes It takes five hours for a single crankshaft to pass through their hands, from the entrance point to the exit door

In that five hours the gleaming crankshaft must prove its accuracy within five ten-thousandths of an inch. A pretty young inspector in blue slacks pushes a gauge—a cylindrical plug with a diamond-pointed push button on its side—through the shaft s hollow chamber. As her hands fly she glances swiftly toward the wall meter with which the gauge is connected, noting at every instant the flutterings of the arrow that records the microscopic deflections the diamond "feels" as it passes along the inner wall

Other inspectors go over the shaft with needle-like gauges, checking the height of each section with blueprint specifications, making the circular surfaces prove they are mathematically round, checking curves with contour gauges Other girls magnetize the shaft in a chamber where it receives an electrical charge then dip it in a bath of kerosene containing minute particles of iron dust that cling in a fine line wherever an invisible crevice or flaw exists, on the surface of the metal or beneath it Sharp eyes search for those hair line warnings that might spell death for the airman above the clouds

These young women have eyes and fingers that coordinate at incredible speed, brain cells that register results infallibly They are the daughters of nimble-fingered ancestors who spun and wove, embroidered and made fine lace

In another automotive war plant women are turning out bomb sights and automatic pilots on factory assembly lines The work is so delicate that if you were to smash a penny into 13 000 parts and let one of the resulting dust particles fall onto one of the bombsight's sensitive mechanisms, the thing would be out of commission Instruments like these used to be made by patient male artisans who devoted their lives to precision work Typical housewives, these mistresses of cleanliness turn them out now in wholesale batches for the night bombing planes which ride over Hitler's industrial towns On these and hundreds of other war jobs, women are demonstrating their efficiency and dexterity

AUTOMOTIVE WAR PRODUCTION

Availability of child-care facilities encourages mothers to take war jobs

In making the switch from the kitchen to the assembly line, a woman often brings along her worries about the family shopping laundry, house cleaning, cooking mending and canning The very woman who has been selected by plant aptitude tests as intelligent, conscientious and self-controlled, will be the most reluctant to shirk her responsibilities to her home

A high degree of human engineering was required, therefore, to help the new woman worker make her adjustments to plant work and thereby help minimize the quit rates and absenteeism among female wage earners

Engineering womanpower means realizing fully that women are not only different from men in such things as lifting power and arm reach—but in many other ways that pertain to their physiological and their social functions To understand these things does not mean to exclude women from the jobs for which they are peculiarly adapted and where they can help win this war It merely means using them as women, and not as men

One automotive plant, for instance, has developed in detail a plan in regard to maternity leave for women workers It encourages women to report pregnancy as early as possible Early reporting permits the management to see that the woman is employed on a job that is entirely safe If her work involves use of a foot pedal lifting or reaching, or contact with chemicals such as lead, she is transferred to something else It is a realistic approach to the employment of married women who now constitute the greatest source of labor supply

The automotive industry has gone a long step forward in opening the doors of new opportunity to woman, by doing a good engineering job on womanpower Today many of the plants employ skilled counsellors to help women meet their problems Employment and personnel policies are geared to the interests and welfare of women employes In addition, the industry actively supports measures for care of children for recreation and for all the things that help make the American family strong

How It's Done — No. 9 of a Series

PROGRESS THROUGH COMPETITION

Years of fighting for the consumer's favor have given the automotive industry the toughness, speed and organization to meet the challenges of war production.

IN THE growth of the United States from an assortment of scattered colonies into a great nation, one of the major catalysts has been competition.

Free competition in the automotive industry created facilities that in peacetime supplied the nation's transportation needs, and that today are pouring forth weapons to hasten the defeat of the Axis.

To those most closely identified with it, the automotive industry has always been "the auto game"—a contest calling for sharp wits and a constant refinement of individual skill on the part of its "players."

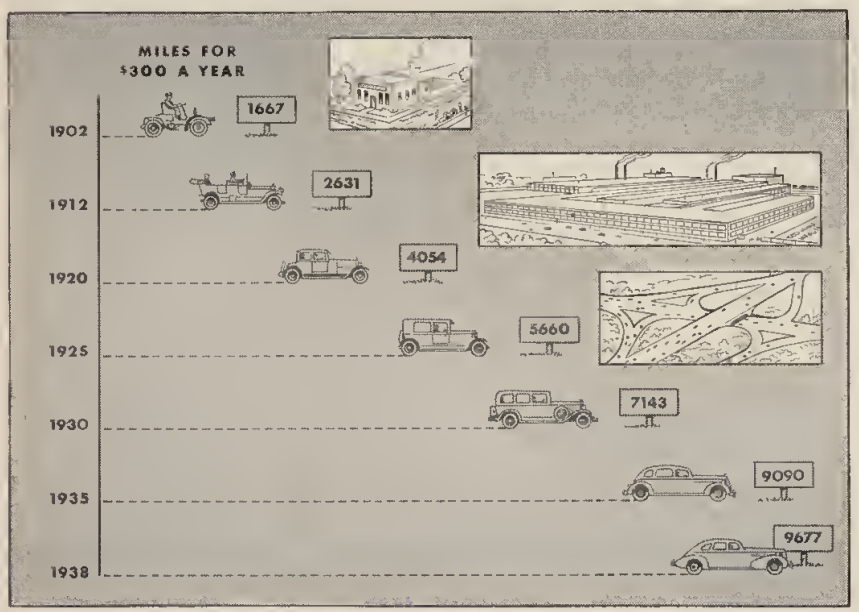
This highly competitive industry's constant peacetime struggle for the consumer's favor is the chief source of the strength which it has been able to pool for the nation's defense in wartime. The fruits of that struggle are the superior vehicles and engines which teams of American and Allied fighting men are today employing against the common enemy.

The refinements of those vehicles and engines are the results of individual efforts to excel competitively. Competition produced them, and competition sharpened the wits and the skill of the fighting men who employ them against the enemy.

Under the impetus of competition in the automotive industry the drive toward better performance was constant. Change—progressive and constant change—became so habitual that, when war came and great changes had to be made almost overnight, this industry possessed the capacity, the ability and the workers to undertake more than one-sixth of the entire nation's war production.

Under the competitive drive, research departments and production departments constantly were on the alert to improve manufacturing techniques and to develop new methods that would result in better products at lower costs. In the years before Pearl Harbor, this industry was spending more than a quarter of a billion dollars annually for research.

Figures based on presentation to Temporary National Economic Committee in 1939



Such striving for higher standards at lower costs naturally broadened the industry's market. And, to meet it, automotive companies pursued a policy of plowing profits back into the business.

For example, by 1923, when the industry reached a production of 4,000,000 units a year for the first time, the resultant profits were sufficient to implement expansions of productive facilities on an unprecedented scale. One company undertook a $5,600,000 building program. Another doubled its assembly capacity. Still another plowed a total of $40,000,000 into plant expansion. The practice was so general that, by 1924, capacity was available for a production of 5,600,000 cars and trucks.

The history of the competitive development of this American industry within the framework of a free enterprise economy is frequently cited as illustration of how products, put on the market originally as luxuries, tend steadily to come within reach of everyone, until they are commonly regarded as necessities.

Though the price of the product declined progressively, its quality was just as progressively increased. For example, in 1920, one large producer offered a car weighing 2,900 lbs., with a 45 horsepower engine, for $2,500; and in 1941, the last full year of car production, this same manufacturer's offering was a 3,160-lb. vehicle, powered with 90 horses, for $965.

While competition is often cited as the force that tends to drive the smaller enterprisers out of the "game," it has expanded the scope of the small manufacturer in the automotive industry. True, more than 1,500 companies built motor cars in the United States at one time or another in the past half century and less than 20 remain in the race today. But, what is often overlooked, is the fact that each of the remaining major producers is today dependent on a constantly expanding network of small enterprisers. These, the manufacturers of automotive parts, sub-assemblies, accessories, tools, and other supplies, became more numerous year by year.

These smaller manufacturing enterprises, many of them launched by men who were once workers in the larger plants but who chose to be venturesome participants in the competitive "game," range in size from little one-room tool and die shops with two or three workers to sizeable industries

with several hundred employes.

Though fatalities have been high in "the auto game," the field is by no means shut off from any newcomers that might wish to pit their abilities against those firms in existence today. As a matter of fact, the patents on the automobile that are available to all manufacturers would be at the disposal of any new company that wished to enter the business.

That Americans are still willing to risk capital in the competitive struggle is apparent from the recent remarks of an executive of one large automotive company. He said that he expects to see at least three new manufacturers enter the post-war automobile market.

With the vast improvement of quality in automobiles, not only did the price of the finished product come down, but also consumer's operating expenses were drastically reduced. From 1906 to 1916 automobile transportation cost an average of 13½ cents a mile. In the succeeding ten-year period costs were down to 5½ cents a mile. From 1928 to 1938, motorists were only paying an average of 2.7 cents per mile of driving.

This, of course, greatly increased the utilization of cars throughout the country. In 1908 there were approximately 140,000 cars in the United States, which traveled 700,000,000 miles. In 1938, 30,000,000 vehicles were in the hands of the public. These accounted for 250,000,000,000 miles, or more than ten times the combined mileage of all other forms of transportation.

During the same period, highway building had a similar growth. In 1908 there were no surfaced roads. Today more than 150,000 miles of paved highways stretch the length and breadth of the nation, bringing economic benefits to the people at large, changing the pattern of both rural and urban life.

AUTOMOTIVE WAR PRODUCTION

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HARRY A. WILLIAMS, Editor

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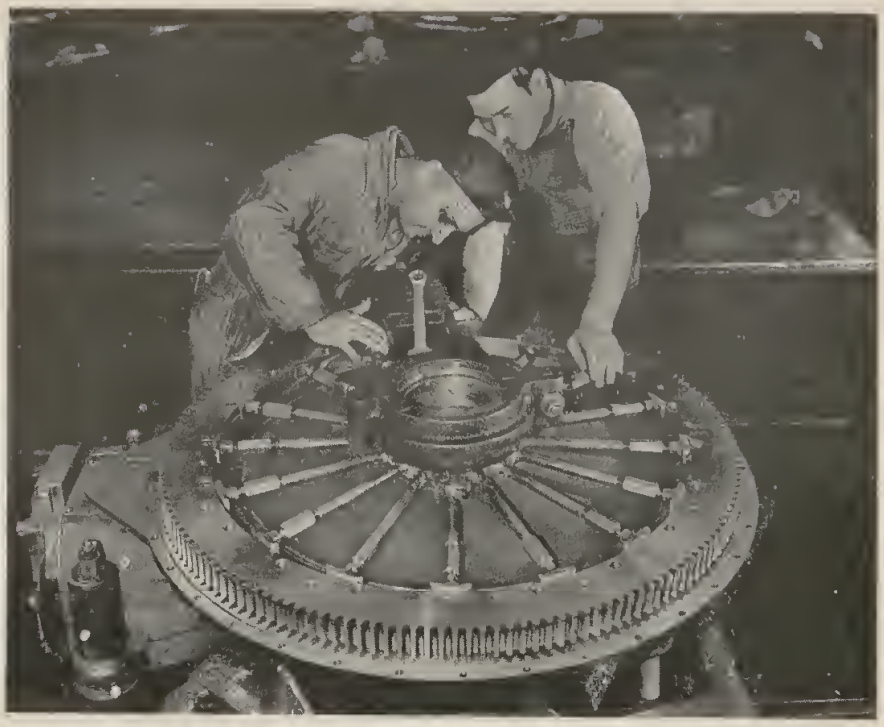

Automotive Firm Employs Ingenious "Spider" In Manufacture of 90 mm Anti-Aircraft Cannon

WHEN busy spiders constitute the sole activity in a factory it is usually a sign that human ingenuity and enterprise have departed from the place. Usually—but not always; for here is a story of a busy factory in which a spider, born as a result of human ingenuity and enterprise, is busily participating in the manufacture of cannon.

This spider is a mechanical device that was developed by a group of ingenious and inventive people in the tool shop of a former builder of motor car bodies.

Some time before Pearl Harbor, when it was becoming apparent that the nation's mounting demands for arms and armament from the automotive industry would eventually crowd automobile manufacturing operations into the limbo of the plants' machinery storage yards, the tool-making facilities of this body company were converted to the precision tasks of tooling for quantity production of weapons.

So well were these tasks performed that the company was one of the nation's first industrial recipients of the Navy E Award, an honor accorded for excellence in the devising and building of special purpose machine tools, jigs and fixtures for a variety of war jobs.

When Pearl Harbor confronted the nation with an urgent need for large quantities of anti-aircraft cannon, this company's facilities were converted for production of 90 mm. cannon.

One of the most difficult operations in the manufacture of this gun was the maintenance of absolute accuracy in the perimeter dimensions of the traversing gear rack—the gear upon which the gun carriage revolves. This huge gear must be a perfect circle.

But, during the process of its transition through the hundreds of mechanical operations that change it from a circular blank into a highly finished gear, it tends to warp. As a machinist would say it, "It gets out of round."

To guard against this tendency, tool engineers developed a fixture which they called a spider, a device with a central body surrounded by "legs."

This spider is used to stretch the gear into a true circle. It can stretch steel as much as six-thousandths of an inch. Believed to be the only implement of its kind in existence, it is one of many reasons why this automotive company is one of the select few whose Army-Navy E burgee boasts three stars.

Touch of Home on Battle Fronts Is Provided By Specially-Equipped Military Vehicles

THIS IS THE ARMY, Mr. Jones. . . . No private rooms nor telephones, perhaps, but there is hot baked bread up near the front, like mother used to make.

And, as for getting a little tailoring on your clothes after you've tangled with an enemy sniper, there's a mobile unit along which carries an electric sewing machine for that purpose.

No matter how far away from civilization the American soldier gets, there's usually some specialized motorized equipment nearby to add a touch of home to military life.

Consider, for instance, the mobile field bakery that the Army has recently added to its long list of non-combat uses of trucks. Operating just behind the front, this unit is keeping U. S. troops supplied with stamina-sustaining, freshly baked bread.

The oven is a gasoline-fired unit, designed so it doesn't give off any telltale smoke which would reveal its location. Weighing 1,100 pounds, this unit comes in two parts, enabling it to be transported easily by truck and set up quickly at a selected spot. Within sixty minutes after the baking begins, 30 two-pound loaves of bread are ready for the troops.

Another mobile unit, recently put into service, is one used to repair soldiers' clothing and equipment in the combat zone. Housed in large trailers, these repair shops have their own power plants and machinery for repairing anything from a pair of shoes to a huge tent.

Going with troops right into the combat zone, the units operate 24 hours a day to keep soldiers' clothing and equipment in good condition.

All trailers are equipped with shatter-proof glass and blackout shades to permit them to work at night in a war zone.

Still another adaptation of motor vehicles, is the sales commissary, which supplies the men at the front with little luxuries such as candy, chewing gum, cigarettes, etc. Though seemingly unimportant in the waging of war, such items receive high praise from Army officers because of their effect in maintaining morale.

The sales unit itself consists of two medium-sized trucks and a cargo trailer drawn by a jeep. Loaded down with popular items, the jeep-drawn trailer gets a great play from the soldiers at the front.

These trucks, like virtually all non-combat Army vehicles, are intended to serve a double purpose. They are equipped so that the shelves and other fixtures may be taken out when it is necessary to use them to transport troops or military supplies.

Keeping the Shine On a Bomber's Nose

Special Fluid Prevents Scratches in Assembly

THE SHINY NOSE, bane of most women, is an absolute essential on a bombing plane. For, inside these shiny noses the bombardiers and gunners brew calamity for the enemy, and the accuracy of their aim depends upon the flawless transparency of the plastic walls of those nose "blisters" or "greenhouses."

Big problem in bombing plane manufacture has been that of keeping the noses shiny as the aircraft are in process of assembly. Nicks, mars and scratches were the common flaws resulting from accidental contact of the transparent panels with air hose, portable light cables, or the buttons on workers' clothing.

To guard against such flaws, production experts masked the plastic sections with layers of protective paper, secured at the edges with gummed tape. This required time—much too much time—both to put on and to take off. Besides, it cut off all light from the bomber's interior.

Eventual solution was a simple one, when it was found. Finders were production men of a former automotive company, who devised and perfected an amber-colored fluid resin which hardens into a tough film on contact with air. Transparent panels for warplane noses and windows can now be dipped in the solution before they are sent to production lines. Or, if mechanics of installation militate against prior dipping, whole assemblies can be sprayed with the resin through an ordinary paint gun, or brushed on like paint. At the end of the line, just before aircraft receives final inspection for delivery to air forces, the film, softened with water, is stripped off in sheets, taking with it all dirt and grime accumulated in the craft's progress through manufacturing operations.

Time saved on one type of plane alone is in excess of 40 manhours per ship.

In accordance with the automotive industry's wartime practice of sharing know-how with all U. S. industries working for Allied victory, full details of preparation and application of the film have been made available to all companies who have need.

AUTOMOTIVE
WAR PRODUCTION

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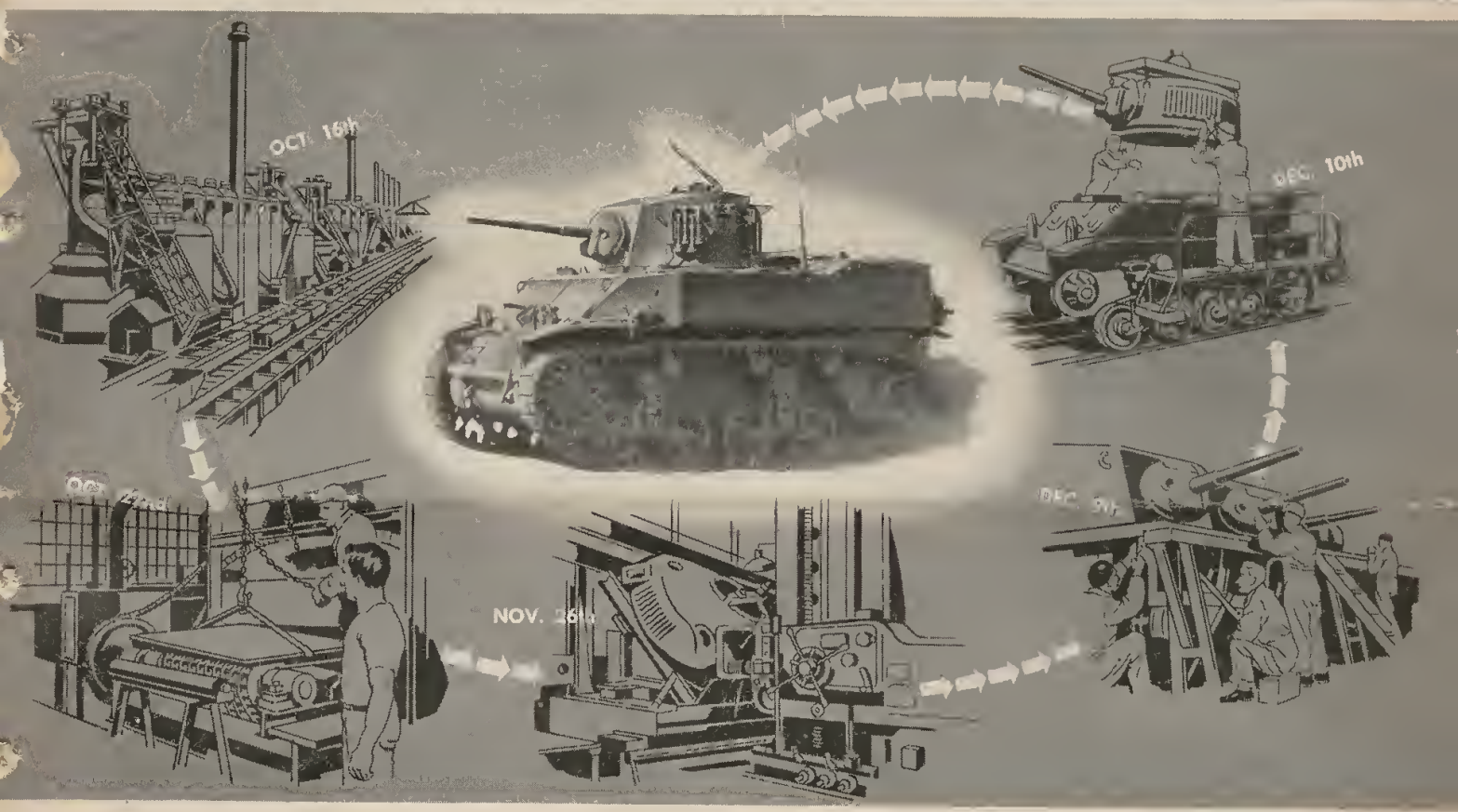


Mass Production Proves Itself Equal to War Job

Advance Planning Basis of Smooth Flow From Raw Materials to Final Assembly

WAR production is very far from done and industries continue to put on pressure to break several critical production bottlenecks. Yet the record of the past two years of war has proved conclusively the case of American mass production techniques applied to the output of military items.

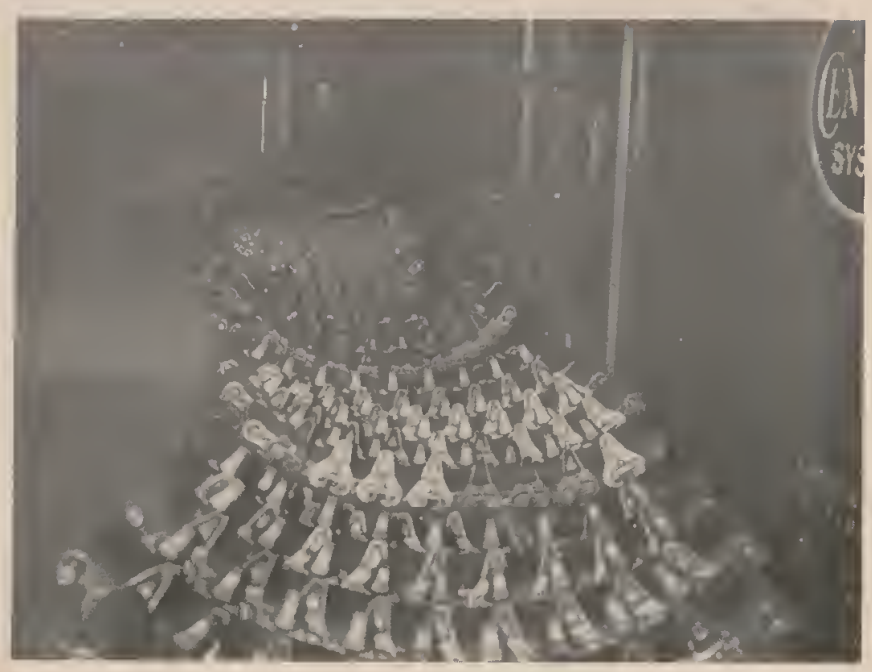
The principal bottlenecks now appear to be tied up with changing designs and new products, an inevitable accompaniment of mechanical warfare on a global scale.

In an increasing number of products, however, the corner has been turned, field requirements have been met and reserves have been accumulated to a point where the armed services have been able to reduce the rate of production and curtail the number of sources of supply.

Today's output has been attained from a standing start. The automotive industry and others, knew nothing before the war of manufacture of tanks, guns, ammunition and a variety of other weapons, but they did know the techniques of mass production.

Production men knew how to take a product from the designing boards and break it down into components. Even more important, perhaps, they knew how to organize and coordinate a production schedule, so that parts and subassemblies could be marshalled from many widely scattered plants throughout the nation into final assembly.

As an industry leader recently told the Truman Committee: "Anybody who really understood the essentials of progressive manufacture (see pages 4 and 5), accurate interchangeability of parts, and mass production, could take the blueprints of anything, and if the blueprints were



Final assembly depends on nationwide suppliers.

Mass Production Proves Equal to War Job

(*Continued from page 1*)

right, he could make it and make it in quantity effectively and efficiently. That fact is what our Axis enemies overlooked."

In wartime, as in peacetime, the final assembly line is the most dramatic aspect of mass production. Yet the casual onlooker is all too likely to miss the real drama behind the scenes of the spectacular flow. Like a great river, the final assembly line is the final effect of a network of tributary streams.

Take a stroll in a converted automobile plant now making light tanks. In the time it takes to walk from one end to the other of the final assembly line, the visitors may see several tanks snort off to the test track.

Behind this orderly progression, in which the bare hull moves through a total of 31 working stations and accumulates its idler wheels, engines, transmission, turret assembly, cannon and track, there is a co-ordinated network of "feeder" lines. These lines exist in this plant and in hundreds of other plants, extending clear back to mines and forests and fields from whence the raw materials flow.

Tracing backward along the stream that feeds the engines to the main stream, you find that the crankshaft, which takes only three minutes to install, required three months for its progressive refinement from steel billet.

The turret slips on the hull in a jiffy, but it required weeks to get it through the machining operations necessary to assure a perfect fit.

Typical of the automotive industry, this company relies on subcontractors for more than half of the thousands of components that enter into the assembly process. These suppliers depend in turn on other companies, with the chain of sources reaching to the fourth, fifth and sixth tiers, and even beyond.

For example, in tracing from the beginning the gasoline-powered generator that is to be installed in tank No. "XY9Z3" on December 10, 1943, it is necessary to go back to August 13, four months earlier, when sheet steel and castings for the unit were shipped from the steel mills, arriving a week later at its first stop, the sub-subcontractor's plant. The 13 by 20-inch frame was stamped out and approximately 100 parts, ranging from tiny valves to a miniature radiator, were installed. Eight weeks were required for this delicate work before the partially-finished unit was delivered to an electrical appliance manufacturer on October 28.

Here, the generator coil and other intricate parts are made. Five weeks are necessary for fabrication and assembly into the complete unit. On December 9,

(*Continued on page 7*)

War Contracts Fall Into Several Types

Cost-Plus Contracts Banned Since 1940

BY ADAPTING mass production methods to the output of weapons, the automotive industry has been able to make sizable reductions in the cost of the war to America's taxpayers.

Savings to the government as the result of manufacturing efficiencies, price reductions and voluntary refunds by automotive firms already run upward of a billion dollars.

The incentive to produce efficiently has been carried over from peacetime, and is further stimulated by the type of government contracts under which automotive plants operate.

The majority of contracts held by the industry are of the fixed price type. This arrangement calls for setting a per unit cost for a certain war product.

Under such an agreement, the manufacturer can gain or lose, depending upon how well he runs his plant. If operating expenses, for instance, run $50 above the set price for a contract calling for 1,000 anti-aircraft guns, he would stand to lose $50,000. On the other hand, the more efficient his methods, the greater the margin of profit between cost of output and the "selling" price of the product, though under such a contract, profits are subject to constant renegotiation.

A second type of contract, cost-plus-fixed fee enables production of new and unfamiliar weapons to get under way immediately when cost data is not available and time does not permit adequate preparation of plans.

The fee, over and above the cost, is a specific dollar amount which does not change with any variations of cost. Subject to audit, excessive cost items can be disallowed, thereby necessitating payment out of the fixed fee.

Another type, the management fee contract, provides for a specified fee to be paid for providing top flight management to organize and operate a wholly-owned government plant.

Contrary to belief on the part of some, there are no cost-plus-percentage contracts, wherein a contractor derives a higher profit if his costs zoom, in existence in the automotive industry. This type, which did encourage inefficiencies during World War I, was banned by Congress in 1940.

WAR IS NO BED OF ROSES

And Management Finds Running a Plant Under War Conditions Is No Picnic Either

Changing needs of battlefronts are being met on the production front.

BECAUSE the armed services have turned to automotive companies for the toughest production jobs and for the widest variety of war products, the automotive industry has felt the brunt of the so-called fluidity of warfare which dictates many changes on the production front.

Despite that, war production in the motor industry continues to rise to levels far above peacetime heights.

From the beginning, battlefront experience and shifts in strategy have been felt promptly on the assembly line. They have created cutbacks in schedules, outright terminations of contracts, and engineering design changes that hindered the flow of production.

Scores of such changes are underway right now. At least four major plants and their suppliers are shifting from production of medium bombers to another type of aircraft.

Two plants that made M-4 tanks exclusively now are preparing to add production of tank destroyers and motor gun carriages. Another, barely started on a medium tank program, is converting to production of subassemblies for Liberator bombers.

Frequently it is changes of design, rather than a change-over to a new product, that are responsible for interrupting the smooth flow of the work. Since one company took over production of the B-24 Liberator bomber, the ship has undergone two complete face-liftings of its nose assembly.

In each of these changes, it has been necessary to shift assembly lines, rearrange machinery and pioneer new production methods.

Like the original conversion from automobiles to weapons, there is often a production gap between the ending of the old design or model and the beginning of the new. It is essential during this time that working personnel be kept intact, for with workers at a premium throughout the nation, the contracting services do not favor laying workers off and a few days later see management compelled to train others to replace them. Obviously, this would be a wasteful practice.

Sometimes schedule changes make deep inroads on plant morale, as in the case of a plant that had orders for so many units for January first delivery, that it kept its workers on the job Saturdays, Sundays and Thanksgiving day. Then, without warning, the contract was ordered cut back.

"It's hard to make workers believe that every minute counts after something like that," the plant manager observed.

Yet, despite such discouraging experiences management keeps at the job of infusing new energy and instilling new spirits into workers and supervisors. The goal is production—and it is being achieved despite setbacks in morale here and there.

Even in wartime, there are some instances where model changes or shifts to new products can be made smoothly. M-4 tanks followed M-3s off automotive assembly lines without a slowup in production. In the current conversion in the industry to the new super bomber, careful plans have been laid whereby the new job will merge on the old with little or no lost motion. When the last medium bomber fuselage has completed its ride down the assembly line, the first fuselage for the new ship will be right behind.

However, any number of factors prevalent in a wartime economy can upset the best of well-laid plans, and they often do. Materials shortages may crop up. A supplier may fail to deliver on time one of the many new jigs and fixtures that will be needed. Or a machine may break down, bottlenecking everything behind it.

In the face of war's uncertainties and complex problems, industry has steadily pushed its output of tanks and planes and guns to new highs each month. In the automotive industry, current production is running at an annual rate of $10,000,000,000—more than twice its best peacetime year.

B-24 bomber gets two "face-liftings."

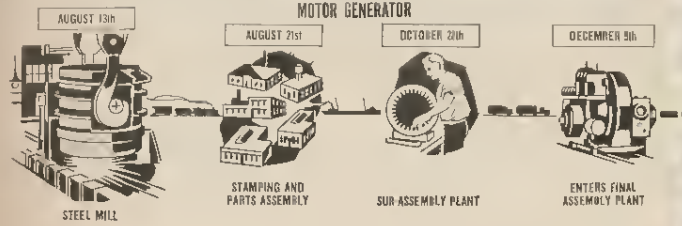
THE SCIENCE OF MASS PRODUCTION

It's the "flow technique." Precisely timed in its motions as a set of intricate gears, it keeps finished parts converging on the final assembly line at just the day and hour when each is needed to take its place in the finished war machine. These regiments of parts that fall in place so accurately began as raw materials months before.

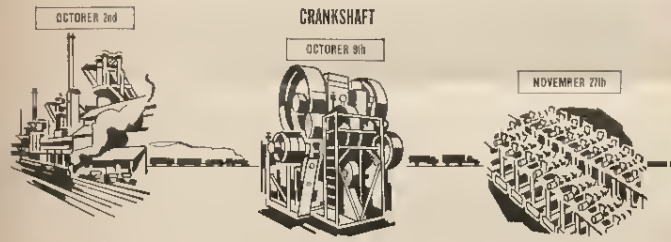
Their schedule was charted and co-ordinated so that they might never miss a rendezvous, from mine to mill, from mill to sub-assembly plant, and so on up to the final assembly line from which they will leave for the far-flung battle fronts of the world.

The march of the raw materials is always beginning. Millions of precision-machined forgings and castings, bearings of many sizes, gears, shafts, pistons, rings and track links join forces as they go. It looks easy when you see a tank magically assembled "while you wait." But the ease with which it goes together is the result of the engineering and production skill that went into every phase of the plan.

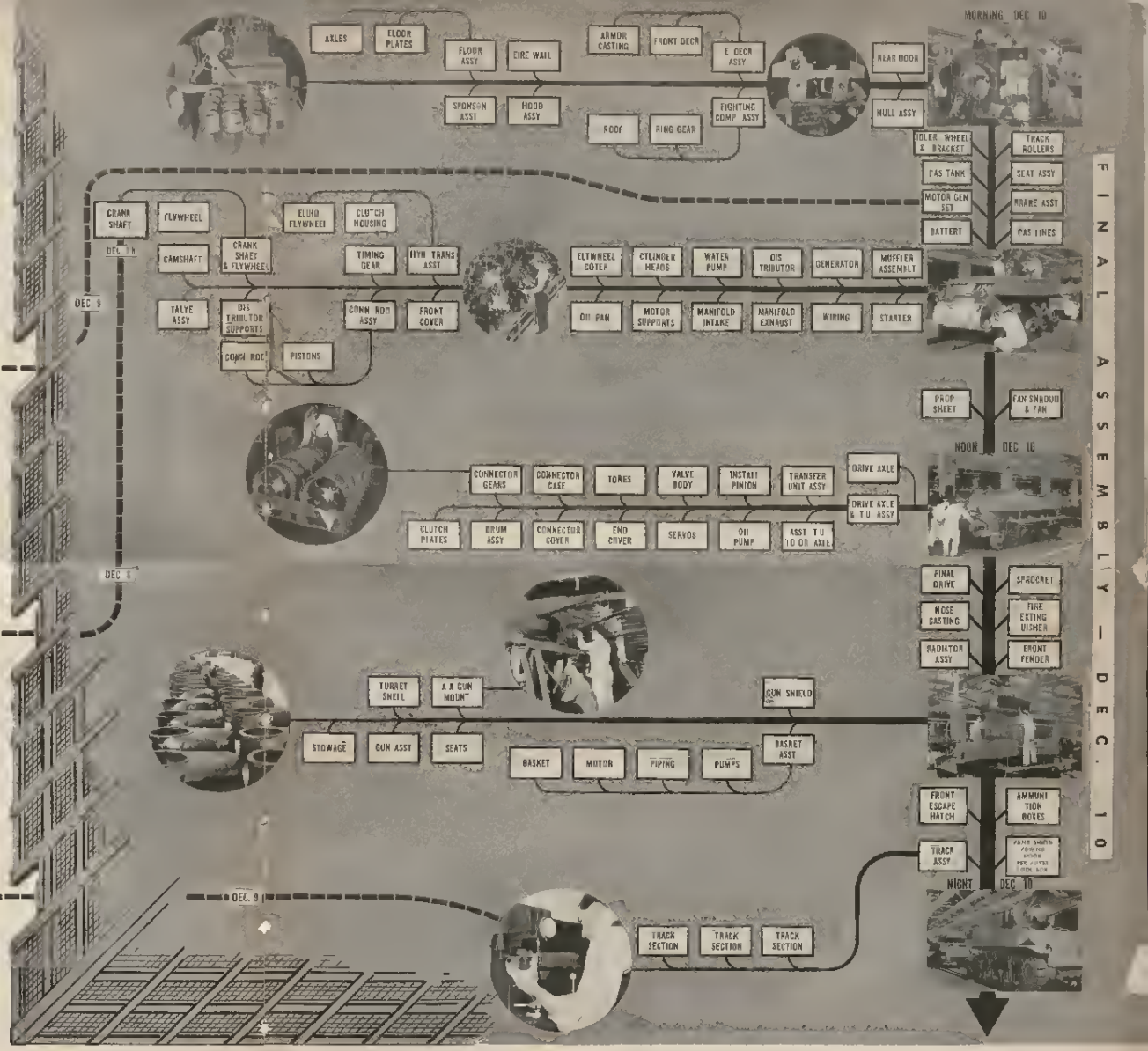
MOTOR GENERATOR

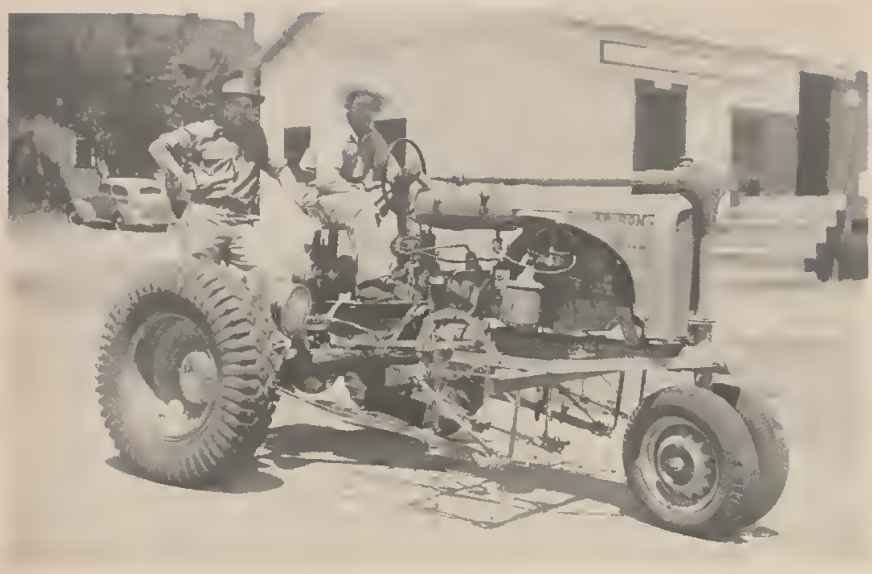


CRANKSHAFT



TANK TRACK





Old truck parts become "jitterbug" tractors on Ohio farms.

American Farmers Offset Wartime Shortages With Barnyard Odds and Ends and Ingenuity

THE AMERICAN FARMER in wartime is the foremost "ersatz" engineering genius in the world. When he sets up an assembly line in the cornfield, things really begin to move. Squeezed between manpower and equipment shortage, he just gathers up odds and ends, and rigs up machines to do his work in double-quick time.

Sometimes he even goes in for war production on the side, as the farmer in Maine who rigged up a barn with machinery he constructed out of parts of washing machines, automobiles and such, and put two helpers to work grinding and polishing binocular elements on regular schedule for delivery to Army Ordnance.

Usually, though, the problem of meeting crop schedules is all he has time to bother about. You can't order a farm tractor from a mail-order house these days, but one farmer, at Geary, Oklahoma, found he could stir one up for himself out of parts of two old trucks.

In Ohio, a handy garage mechanic started a farmer craze for the jitterbug tractors he could put together from old truck parts for $100 apiece. Now many farmers are building the jitterbug themselves. The contraption doesn't pretend to do the heavy work of a general tractor. But it will mow, rake, pull off hay, pull the corn binder, sow oats and wheat and perform a variety of other farmyard tasks.

The only two autos that ever successfully "took to the air" may be viewed in full flight at the Ebling ranch in Oklahoma. The twin frames were welded together to form a tower, on top of which a rear axle was bolted with its shaft pointing upward. Four halves of oil drums form the wind cups for the resulting windmill, which pumps the farm's water supply. From one end of an axle housing, the brake mechanism was removed, and the section joined up so that only the opposite end moves through the differential. A crank, made out of a part of the steering gear, was attached to the moving end of the axle just outside the brake drum and connects directly with the pump plunger.

Another Oklahoma farmer turned two old trucks into one tractor with 48 speed combinations, at a cost of $175. In Story, Iowa, the motor of an old auto, mounted on a stationary platform, provides the wartime power plant for a grain elevator. Another Iowa grain elevator utilizes lumber and some old bed frames, mounted on the rear axle assembly of a junked car. Power is furnished by a small gasoline engine mounted behind the car wheels.

An old car becomes a buck rake in Onondaga County, New York, a power-driven shovel on a California farm.

There may be a shortage of farm hands and farm machinery. But the average American has "mechanical imagination" that far exceeds that of the average citizen of other lands. The American farmer is no exception to that rule. The mechanized might that is sending clouds of Flying Fortresses over Berlin has its counterpart down on the farm, where food for fighting men is being raised, despite all the handicaps of war.

Odd Items Required For War Production

MANY AN UNUSUAL item has crept into the shopping lists of automotive purchasing agents as a result of war production needs.

Toothpicks, dish mops, pure mutton tallow, dry ice, canvas foot covers, police whistles and razor blades are just a few of such implements being used by one company in its production of aircraft engines and combat vehicles.

Dish mops, the same as in every kitchen, are used for applying drawing compound on stampings. Dry ice serves as the ideal agent for cooling plating solutions, while canvas foot covers protect freshly-painted vehicles while men are working inside.

Pure mutton tallow was called for when production men found it to be an excellent lubricant for wooden assembly channels. And, because the shrill tones of police whistles were able to penetrate the factory din, they became the perfect warning signals for the operators of heavy hoists and cranes.

Toothpicks are used by the first-aid departments for medical dressings.

AUTOMOTIVE WAR PRODUCTION

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HARRY A. WILLIAMS, Editor

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Plane and Oil Tower Go for a Truck Ride

A GIANT of the skyways recently tried riding with two giants of the highways.

There was consternation at an airfield in Houston, Texas, recently, when it was decided that a 21-passenger DC-3 transport plane would have to go to Dallas for repairs.

As the crow flies, it was a short hop. But getting an ailing giant that stands 21 feet high and 24 feet wide over 240 miles of highway is not easy.

Officials looked in vain for a conveyance big enougb to handle the huge bird. Finally two six-wheel trucks were hitched together like a team of dray horses, with the plane straddling their twin expanse.

When this strange convoy got under way, the 240 mile trip was increased by another 100 miles of detour, to avoid low underpasses. And at 45 bridges, it was necessary to lift the wings over bridge railings with tandem gin poles mounted on the trucks. The trucks managed the haul in four days.

In another feat by trucks, a petroleum tower, weighing nearly 80,000 pounds and measuring 115 feet from base to tip, was moved from its point of manufacture in Dallas out to the oil fields. The tower was mounted on a six-wheeler, and sped along with a highway patrol clearing the way for it.

MASS PRODUCTION

(*Continued from page 2*)

the generator is scheduled to arrive at the tank plant, to take its place behind previously completed units which are converging on the final assembly line.

When tank "XY9Z3" arrives at station No. 6 the following day, this generator, that had its start four months earlier, will be ready for installation.

While this traces one phase of the job to completion, there are many others like it, each involving a series of production steps. For as soon as a generator, engine or turret has gone through one stage of manufacture, another has progressed from the previous operation to take its place.

This is the foundation for a system of mass production which enabled America, where only 30 tanks had been built in the 20 years following World War I—and these by hand methods—to turn out hundreds of tanks each day.

Automotive skill helps meet huge supply problems on bottlefronts.

Army Regiment, Staffed with Automotive Men, Lauded for Work in Mediterranean Theater

A FIGHTING Ordnance regiment, composed mostly of over-age men who used to keep America's automobiles and trucks running at peak performance, has achieved distinction in the Mediterranean theater.

Established in record-breaking time, the regiment is composed of expert mechanics, technicians and executives from 22 states. About 60 per cent of the men are married, while their average age is 10 years above the draft age average.

"This regiment," according to an Army announcement, "rendered valiant, capable service in distributing and maintaining guns, tanks and ammunition in both the Tunisian and Sicilian campaigns."

Behind this announcement is a story that began shortly after Pearl Harbor when a small group of men, representing America's automobile dealers, appeared in the nation's capital to inquire: "What can we do to help win the war?"

In answer, Army officers asked them to recruit trained personnel for Ordnance maintenance battalions. For it was recognized that to keep fighting troops operating at full efficiency, it was essential to provide well equipped and well manned service facilities. As one ranking officer puts it: "One tank in good condition over there is worth a hundred rolling off assembly lines here."

The recruiting assignment was a natural to these automobile men. For nowhere in the world was there a greater nucleus of experienced administrative personnel, mechanics and parts experts than in the nation's 40,000 automobile dealer establishments. Over the years, facilities for distributing and repairing automotive products naturally grew apace with the increasing tempo of final assembly lines. In peacetime, nearly a million-and-a-half people were employed in just this one phase of the industry.

Even though it meant the thinning of their own staffs at a time when servicing and repairing cars and trucks was their remaining source of livelihood, the dealers organized a nation-wide drive and within 60 days two regiments composed of 8,000 officers and men had been recruited.

Subsequently, more than 26,000 men who formerly earned their living in the vast peacetime automotive industry enlisted in the Ordnance department of the Army. In all, four-and-a-half base regiments, nine battalions and 91 companies were formed, chiefly through the help of automobile dealers.

Production of Aircraft Material Accounts For 41% of Total Automotive War Job

BEHIND current attempts to knock Germany out of the war by means of airpower, stands the teamwork of the automotive industry, which has done much to get bombers in the air over Hitler's domain.

The motor industry, starting as a scrub team in the aircraft field a year before Pearl Harbor has since attained major league stature.

In the two years since December 7, 1941, the industry's output of bombers and fighters has constantly soared. Measured in dollar volume, it rose from four hundred million ($400,000,000) annual rate of production on the day of the Japs' assault, to forty-three hundred million ($4,300,000,000) on the second anniversary of that "day of infamy."

The same upward spiral took place in deliveries of all forms of war materials by automotive plants during those two years. When the news of Pearl Harbor hit the world, they had reached an annual production rate of $1,777,000,000 for all forms of military requirements: aircraft, military vehicles, tanks, guns, ammunition, marine engines and other equipment.

Today the annual production rate tops the $10,000,000,000 mark.

In that time the full force of this industry's productive might has been fused into an industrial "striking power" that will ultimately be turned against Tokio as it has against Berlin.

There has also been a constant shift in emphasis toward ever-increasing volume of aircraft. Output of all war products has risen, but the proportion of each to total output has significantly changed.

Thus, at the date of our entrance into the war, military vehicles were 52 per cent of this industry's manufacture of war supplies. Today their output has almost tripled, yet they constitute only 27 per cent of the stream of war weapons pouring out of the plants.

In the same period aircraft production has risen from 23 per cent of factory output to 41 per cent.

Perhaps only plant managers and their engineering staffs fully appreciate what that rise means. Making bombers and fighters is a competitive business too, in which the nation is competing with the tireless skill and imagination of a determined foe.

Knowing we can lose the war by merely turning out quantities but letting the enemy steal a march in design, the U. S. Air Corps maintains designs that are fluid.

So, mass production of planes is unlike mass production of automobiles, for even as the big birds move down the assembly line, hundreds, even thousands, of improvements of their design arrive and must be made.

At one time one automotive company reported it had 4,000 engineering changes pending on the big four-motored bomber it was turning out, and stated that these were being assimilated into assembly line procedure at the rate of 25 to 50 a day.

Despite such factors, this plant has maintained an excellent record in utilizing its working force to the fullest extent. The War Production Board recently revealed that the output per employe in this plant was one-third higher than the nationwide average of firms producing aircraft.

This company recently reported that a thousand bombers had been flown away from its plant during the past year, along with hundreds of others that have been shipped in knock-down sets for final assembly elsewhere.

Automotive Plants Pool Health Facts

STANDARDS covering the health and safety problems of women workers and of rehabilitated war veterans have been drafted by the automotive industry, through its Medical Panel of plant physicians.

The Panel was convoked some time ago by the Automotive Council for War Production, as a means of pooling the experience and knowledge of the industry. It is studying such matters as industrial fatigue, prevention and cure of dermatitis, standards in dealing with pregnancy of women workers, and the rating of industrial jobs suited to employment of disabled war veterans and handicapped persons.

The practice of sharing and exchanging medical and health information among the member companies is merely an extension of the industry's general wartime policy of pooling ideas. As in the case of exchange of data on manufacturing practices that has so greatly contributed to output of war products, this new collaboration to promote the well-being of workers is one that is expected to profit the Nation as a whole.

1943 INDEX JANUARY THROUGH DECEMBER

AUTOMOTIVE WAR PRODUCTION

Automotive Council for War Production

THE following index to Volume 2 of AUTOMOTIVE WAR PRODUCTION lists alphabetically and by cross-reference the subjects treated in the issues of January through December, 1943. NOTE: AUTOMOTIVE WAR PRODUCTION was not published for November.

NEW CENTER BUILDING, DETROIT 2, MICHIGAN

WOMEN IN WAR INDUSTRIES

AUTOMOTIVE WAR PRODUCTION

Vol. III No. 1 | Published by Automotive Council for War Production | January, 1944

Changing War Models in Mid-Stream Is Difficult

Switch to New Product when Old Is Cancelled Involves Heartaches as Well as Headaches

WARS are won or lost, Tolstoi pointed out, because of that unknown quantity X, standing for the human element. Morale, backbone, grit, determination, ability to withstand reverses—are components in that unknown.

On the fighting front, battles are won by that type of commander who can march his men across mountains, deserts or raging rivers to meet the enemy—and when the strategy of the war demands, march them back across those physical obstacles with their morale intact.

Home front "battles", too, are won by the management and workers who can "take" orders to reverse their steps after a long industrial march, and who then are able to apply their energies in another direction, on another assignment.

In the automotive industry, management repeatedly has been called upon to supply leadership and drive to keep its war production job humming, in the face of such "reverses."

Nearly two billion dollars' worth of contracts and subcontracts, for example, already have been cancelled in the automotive industry, as a result of the constantly changing strategy of the Allied High Command and shifting tides of battle. Production schedules of scores of other jobs have been reduced, as the requirements of the armed forces have called for increasing quantities of some weapons and lessened the demand for others.

Many of these setbacks on the home front have come even before "production soldiers" have had a chance to "fire a single shot." After covering the long and tough road of preparing blueprints, laying out plants, arranging assembly processes, and tooling up machines, workers and management have been ordered to "fall back" and make a new "attack" on another weapon.

Maintaining worker morale in the face of such wartime conditions and bringing the utmost energy to bear on the new objective, calls for the most capable leadership that automotive management has been able to muster.

A graphic example may be shown from the recent case of one automotive company that had spent 15 months in preparing an old railroad factory for production of a new streamlined tank, only to have the contract cancelled and

(Continued on Page 6)

HOW IT'S DONE

NO. 10 OF A SERIES

Automobile Dealers Offset Lack of Cars By Concentrating on Service and War Work

COURAGE to get off the canvas at the count of nine, then rally in the late rounds to win the decision marks a real champion.

Similar fortitude has been demonstrated by the automobile dealers of wartime America. "Floored" when their livelihood appeared to be cut off with the halting of car production, they not only made a quick recovery but have come forward to perform an important wartime function.

Largely through their combined efforts, a nationwide transportation crisis has been averted. Despite shortages of repair parts and a lack of skilled workmen, they have kept nearly 25,000,000 cars and trucks on the road, hauling war workers to jobs, rushing vital materials to mill and factory, carrying food to market and metropolitan areas. By concentrating on their service and repair departments, more than 80 per cent of these enterprising businessmen have stayed in business during the war period.

In addition, hundeds of automobile dealers have installed machines and equipment in their vacant showrooms and are turning out parts and assemblies for guns, aircraft engines and other weapons.

More than 300 dealers of one automotive company, for example, are engaged directly in war work. One of these, located on the East Coast, is operating a large supply depot for the Army as a prime contractor. Another has contracts totalling more than a quarter of a million dollars. In one metropolitan area, 17 dealers of another company have taken on war contracts to supplement their parts and service business. Many other dealers have added the sale and distribution of new items or have entered new businesses for the duration. These include home and auto supply stores, home appliance stores, bus lines, taxis, rentals and trucking, wholesale gas and oil, live stock and farming, tire recapping and repairing, heating equipment, paint stores, food lockers, blackout blinds, salvage yards, airplane sales and service, bomb extinguishers, and coal and fuel.

Though it meant a further thinning of their own staffs, automobile dealers patriotically came forward and actively assisted the Army in its recruiting of trained administrative personnel, mechanics and parts experts for Ordnance maintenance battalions. Today, more than 26,000 men — most of whom came from dealer establishments—are servicing and maintaining American weapons all over the globe.

Modern counterparts of the enterprising Conestoga wagon makers of the 18th century, automobile dealers are a striking example of the venturesome, ingenious, hard-working individuals that make up the American free enterprise system. Operating in the world's most competitive industry, these small business men have faithfully carried on a tradition of serving the public. Contrasted with European cartels, there has been no price fixing or other measures to restrict competition in this industry.

Automobile dealers, in their capacity as the industry's representatives on Main Street, have helped transform a luxury product into a family necessity in the past three decades.

Their products have created new markets, new opportunities for jobs. Motor transportation has brought towns and rural areas within easy reach of the cultural, business and religious facilities of the city. It has built thousands of miles of roads and highways, enabling the farmer to bring his goods to the city, and put inhabitants of the city within a few minutes of the country.

In the early days of the industry, when capital was needed for manufacturing facilities, it was the dealer's willingness to risk his money that enabled the infant industry to gain a solid footing.

He paid spot cash on receipt of his cars, thereby enabling the manufacturer, who usually operated on a 90-day basis with parts suppliers, to meet his payroll and creditors' bills with a minimum outlay of his own limited capital. In a period of financial stress following World War I, at least one manufacturer was pulled through by the strength of its dealer body.

Energetic merchandisers, blazers of new economic trails, the automobile dealer has contributed much to a greater America. And, in the years to follow the coming peace, the established reputations of integrity and fair merchandising of the remaining dealers —fostered by their wartime service— will be a valuable asset to the industry when cars and trucks are available again and the competitive race resumes.

MANY centuries ago the author of the *Rubaiyat*, a philosopher and sage called Omar Khayyam, wrote critically of the "paradox which comforts while it mocks." Today, in the midst of global war, the automotive industry is considering a modern parallel to Omar's observation. There is a shortage of common labor.

Long noted for its high degree of mechanization, the automotive industry has succeeded in getting a high degree of efficiency and productivity out of man-hours expended on the job. Much has been accomplished through the use of special tools, jigs and fixtures which "build the skill" in the machine.

Technological advances resulted not only in production increases and lower market prices for the products, but also in benefits for the industry's workmen, in the form of cleaner, safer and less arduous jobs. When war production demands raised the industry's employment levels to new peaks, it was possible to meet huge production quotas only because new workers could learn their jobs quickly and thoroughly, and because women could now be used to a greater extent than ever before.

Yet, some very necessary jobs still call for common labor, jobs that have been mechanized to the greatest possible extent, yet still require "sweat of the brow" participation. Since they involve less pleasant working conditions, or more strenuous physical exertion than assembly line work, they are being left unfilled by workmen who gravitate toward those jobs which technology has made more desirable.

Automotive personnel men find that workers who are offered common labor first "shop around" at other plants for assembly jobs, and since industry does not have the persuasive powers of an army sergeant, it becomes necessary to "sell" the job to the applicant.

By appealing to the American spirit that is determined to win this war, and that recognizes its stake in victory, management tries to get recruits for its less glamorous jobs. Personnel men are employing a variety of approaches.

One company distributed handbills in its neighborhood in order to recruit workers. Another conducted a house-to-house canvass to bring out the town's "muscle and brawn" for laborer jobs. Still another used car cards in street cars and buses, in an appeal to the "big, strong man not afraid of work, to handle foundry work."

Whenever the appeal fails, and a labor shortage exists on the heavier jobs, there is bound to be trouble on the assembly line. Often the assembly line workers themselves—particularly if they are women unfamiliar with the continuous flow of parts and materials that characterizes the mass production system—fail to understand what causes the halt that leaves them standing idle for several hours for lack of castings, forgings and parts to work on.

All of which leaves the automotive industry facing a modern demonstration of Omar Khayyam's famous phrase, comforted by its technological progress and the hope it holds for the future, but mocked by the way that progress has added one more aspect to the war manpower problem.

Novices Take on Jobs of Drafted Workers

IN the face of a drain of over 225,000 men to the armed forces, the automotive industry has steadily increased its payroll to today's high of 1,200,000 workers—nearly 400,000 more than its peak peacetime year.

This has been done by drawing on thousands of new workers—lawyers, clerks, housewives, salesmen and others who had no acquaintance with mass production. Yet, automotive firms have been able to meet war output schedules without once slackening the pace.

Lacking a knowledge of the fundamentals of mass production, these new workers often are puzzled to discover that output can continue for a day or two without seeming impediment while men are drafted, workers fall ill, or while a part of the labor force is absent the day after a holiday. The system of mass production is misrepresented as a system operated like a football team, where eleven players are on the field and the coach sits on the bench with 30 or 40 others, ready to put them in as replacements for the original players at any time.

Actually, the mass production system is able to absorb most of the shocks of worker dislocation because it is based on detailed, minute advance planning which attempts to foresee and circumvent just such eventualities as far as possible.

Protracted losses of labor energy will of course ultimately cause a loss of production in the main assembly plant. Yet, temporary losses of labor energy will not necessarily cause a decline in output.

The mass production system maintains a certain margin of safety in its calculations of the parts and subassemblies needed, and therefore builds up a protective inventory of them when they are being supplied on schedule. Only after the inventory is exhausted does a shut-down of operations occur.

Back Yards to Battle Fronts

American Boys Put Hobbies To Work In Mechonized Warfare

REMEMBER those pre-war Sunday mornings when the kids next door woke the neighborhood with the roar and clangor of an unmuffled engine in a jalopy with a "fronty head"?

These same boys, now clothed in khaki are risking their necks on land, sea and in the air to save our necks. By applying a knowledge of machanics gained yesterday in the backlot, they are ingeniously keeping all types of motorized equipment running—to keep the enemy on the run

That peacetime Sunday morning clamor was a bad noise for the nation's enemies, even then It meant that American boys—those next door and a few hundred thousand besides—were learning to use their heads and their hands, to tinker with machinery and motors, while youths of corresponding ages in Axis lands were merely exercising their feet in the goosestep

Those American youngsters are now waking up the world Some have become the war plant engineers and the men at the Army and Navy drawing boards, who manage to keep us always a jump ahead Still others are pilots and ground mechanics flying and servicing our big bombers and fighters, or the Naval officers who can handle everything from a P T boat to a battleship In remote theaters of war, by sheer ingenuity, against all kinds of mechanical odds, they manage to keep motors whirring—just as once they kept the flivver running with the aid of a piece of string and a bit of baling wire

America's foreign critics referred to us as 'a nation of mechanics' whose culture ended at the wrist joint They implied that it was effrontery to speak of educating a youth when he was allowed to spend half his time in the basement workshop or the garage, the other half on the athletic field

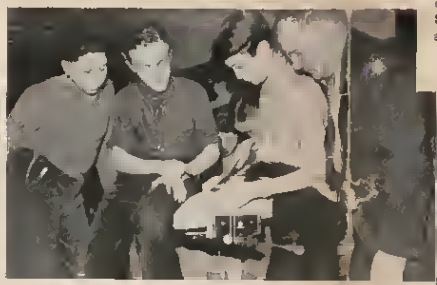
Probably no nation had a youth movement as lusty and as *informal* as that in the U S A before the war It took a variety of forms, under all sorts of sponsorship Much of the leadership came from industrial groups who frankly admitted they stood to profit by the rearing of a future generation that could fit into the pattern of the nation's mechanical progress The automotive industries sponsored projects enlisting the activities of many thousands of boys They launched the National Soap Box Derby, the Craftsman's Guild and the industrial trade schools where teen-age youngsters could give practical expression to their mechanical aptitudes

During the years of its life, beginning in 1931, the Craftsman's Guild had more than a million boys enrolled from the 48 states They competed for $5,000 scholarships and other large cash prizes and their task was to build a Napoleonic coach similar to the one on the sponsor's trademark It was no easy job—most boys worked at it a full year, and if they didn't win a top prize often started all over again the following year They followed the blueprints furnished them and they taught themselves, in their home workshops, to be experts in four different fields woodcraft, metalcraft, paintcraft and trimcraft

Early scholarship winners in the Guild rate high in aviation and in aircraft manufacture today Take Charles Gadd, of Spokane, Washington, whose prize money put him through the Massachusetts Institute of Technology, from which he was graduated with honors in 1937 He is now a research engineer doing an important war job in an automotive plant Ralph Schreiber of Minneapolis used his scholarship to become an aeronautical engineer at the University of Minnesota

Craftsman's Guild winners Raymond Smith of Amarillo, Texas, and Edward F Sendak of Monessen, Pa., are with the Army Air Corps Smith, now a lieutenant, graduated from M I T and served in the design and styling section of an automotive plant before the United States entered the war Sendak used his scholarship money at Notre Dame, later at the University of Detroit He's a sergeant with a bomber squadron on overseas duty now

American youth's traditional desire to create . . .



Guild winners are spotted all over the earth in strategic places Orville G Backey of Sheboygan, Wisconsin, is now a naval air cadet Truman Cottom of Port Arthur, Texas, is in the bomber ferry service Francis Gadd of Spokane, Washington, is a mechanical engineer, serving with the U S Navy The names are too many to list them all here But this can be said basement workshops before the war turned out the human material from which Victory will be forged, and after it a better world

A few years ago Charlie Baer of Akron joined a long line of auto mekers of the basement-workshop-soap box variety Thousands strong, in all parts of the country, they competed in the local soap box derbies held in scores of cities, and then in the National Derby, where the prize was a university scholarship They were boys from 11 to 15, who spent all their spare time for months learning skill with saw and plane, with the mechanism of perfectly rolling wheels and steering gear, with line and design and paintbrush In time their models became as sleek and streamlined as any the grown-up manufacturers could produce

Charlie Baer is a night flier in the Pacific war today. After coming through the stiff training at Thunderbird Field, Arizona, at Pecos, Texas, and at the Orlando, Florida, airbase, he was shipped overseas a few months ago His mother wrote a proud letter to the automotive sponsor of those soap box derbies that had meant so much to her son Proud, but not too much so "Charlie wouldn't like to be called a hero," she said, "he's just a typical American boy."

Following the same path is soap-box derby champion Jack MacDonald of Seattle, Washington, who began his aviation cadet training a few months ago He and hundreds of other soap-boxers are changing vehicles—from a home-made car to a high-powered plane. But the mechanical and technical skill they learned in the home workshop will stand them in good stead

. . . to acquire technical knowledge . . .

This war can be won by superior technical skill, our boys are proving that. In remote combat areas they are showing how technical "know-how" spells the difference between smashing victory and overwhelming defeat "Cannibalization" is their invention—the "plane-eat-plane" idea that helped General Chennault's Flying Tigers to rise out of their own ruins and lick the Jap Zeros with planes they had reassembled out of wreckage that lay on the ground

They Were Expendable tells a similar story, of sailors in the stress of Pacific war, able to repair their PT boat quickly, after a coral reef had smashed her rudders, struts and propellers into a jumble of bent steel

In the war plants where the planes and tanks and motors are being built, it's the trade school boys who carry the heavy load today In pre-war years these schools were set up near several of the large automotive plants, to prepare adolescents for mechanical work in this field

The popularity of the trade school is illustrated by the experience of one of them that started with 15 boys enrolled Enrollment rapidly rose to 600 with 4,000 on the waiting list Then the automotive sponsor gave the order, "reverse those figures" But it couldn't be done When enrollment reached 1,800, the waiting list was 8,000

Operating under a system which provided allowances in addition to all expenses, the students paid with their work for their education What they produced was not discarded, but was sold to the plant Each day the younger boys repaired thousands of screwdrivers, wrench, hammers, oil cans, shears and hacksaw frames, and hundreds of pairs of safety goggles From the very first, a boy could feel that he was a producer Later he went on to learn the manufacture of tools—cutters reamers drills, arbors—anything that any good tool shop could turn out He had academic courses too—civics, economics, auto mechanics, physics, general chemistry, qualitative and quantitative analysis and metallography But these classroom subjects, like everything else he studied, were carefully related to practical use

A graduate from this school was virtually sure of employment. One company took 40 per cent of the graduates itself, the rest easily found jobs in other automotive plants

What happened to America's youth who had been educated in mechanical things, when war came? Well, very much what happened to the automotive industry itself The year before Pearl Harbor the automotive plants had produced millions of passenger cars for Americans The year after Pearl Harbor they were as rapidly converted to the gigantic task of turning out the instruments of war

"Conversion to war" affected the youth of America much as it did the industry The things they had learned were still vital, they merely needed to be applied in different ways

. . . to compete and excel is paying off today on war fronts.

Special welding equipment is scrapped in changeover to new product.

Conversion to New Weapons Is Difficult Job

(Continued from Page 1)

a new product ordered, just as the first models were coming off the line.

To incorporate battlefront lessons, such as those learned in the El Alamein campaign, in the new tank, it underwent many engineering changes during its development stage. In all, orders for more than 5,400 changes came through from Ordnance officers, with the original 20-ton model finally emerging as a 28-ton job.

It took from December, 1941 to March, 1943, before all the major "bugs" had been ironed out, and the assembly lines began filling up with tanks. Some were nearly complete, some were awaiting installation of bogey wheels or guns, others were just beginning to take shape at the beginning of the line. All along the assembly lines, parts and sub-assemblies were stacked up, ready for installation. More than 250 hulls were completed before a single tank had rolled off the line.

Workers and management alike, at last seeing results from their months of hard work, justifiably were proud.

Then the news broke . . . the Army had cancelled the contract! Shifting emphasis on global battlefronts had relegated tanks to a lesser position, and production facilities were greater than the Army's requirements.

Understandably, morale sunk to the depths in this automotive plant and it was a thoroughly demoralized crew that trudged home that evening. For, after 15 months of effort, only 13 tanks —seven pilot models and six production models—had been built at an estimated cost of 36½ million dollars.

In place of the tank, however, the Army wanted an 18-ton prime mover—a tracked vehicle rugged enough to climb the mountainous terrain of Italy and powerful enough to plow through the mire of New Guinea.

An open-top vehicle, the prime mover carries an eight-man crew and a full supply of ammunition for the 155 mm. cannon it hauls behind. About the only similarity between it and the tank is full tracks of both vehicles.

Yet, the need for the new weapon was urgent. And, setting an example for the entire working force, management tackled the job with a vengeance. The disappointment of the previous effort was soon replaced with enthusiasm for the new task.

In rearranging the plant's 1,320 by 440-foot floor space, for example, it was necessary to move every one of the 1,154 tank machines, all of which were government owned. Eventually, 706 were converted to production of the prime mover, while the remainder were either shipped to other companies or placed in a vacant corner of the plant. The last of the tank equipment, including six huge vertical boring mills worth $25,000 each, were shipped to an Army warehouse early this year.

Only about 10 per cent of the tank's jigs and fixtures were usable for the new contract; the rest had to be discarded as scrap. A battery of unique end-over cradle fixtures for welding the front, rear and top of the tank had to be ripped out and scrapped. Their pits, where they dipped below the floor level, had to be filled in before the space could be utilized.

Carloads of materials that were useless for the new contract were shipped out to other tank arsenals or scrapped. The 250 hulls that had been built in advance were cut up and re-melted into raw materials. Each represented an expenditure of $16,000.

While tank machines and materials were going out, new equipment was arriving and being installed for production of the prime mover.

New bases had to be dug for a battery of drill presses. It took a month to acquire and install a network of individually-operated cranes for handling the prime mover parts. Two weeks was necessary for installing a special drawing furnace with a 10-foot underground foundation. It also required two open pits for handling the white-hot parts.

Nearly three months was required for the complete transformation from tanks to prime movers. Though the Army sought to eliminate a labor turnover during this period, by offering employment at a nearby government arsenal, this firm estimates that it lost 35 per cent of its best mechanics.

Before an accurate claim could be made for payment for work done on the tank contract, forms were fanned out to 431 first-tier subcontractors and to as many as 1,500 other suppliers.

In order to expedite this work and assist smaller companies, both the automotive firm and the Army set up special termination departments.

Even with this assistance from the prime contractor and the Army, termination proceedings are not yet complete. The status of the contract, as of December 31, 1943, was as follows:

A total of 363 claims had been settled in full. Eleven were in the hands of Army Ordnance officers awaiting approval. Fifty-five were being processed by the automotive firm, while four of the largest claims have not been filed. The latter are held up, awaiting claims from subcontractors.

Though the paper work is still to be completed, the plant today is running smoothly, turning out prime movers on schedule. But, typical of the unpredictable events of wartime, this contract already has been cutback 50 per cent.

AUTOMOTIVE WAR PRODUCTION

Published by

WAR PRODUCTION INFORMATION DEPARTMENT

Automotive Council for War Production

HARRY A. WILLIAMS, Editor

New Center Building, Detroit, Michigan

DO YOU KNOW?

An order for thousands of bombsights of a British design has been completed by an automotive company which mastered the complexities of making the 4,200 tiny parts required for each sight, and of holding tolerances as low as .0008 of an inch.

* * *

More than 3,255 leather jackets and windbreakers for seamen and service men have been made from 25 tons of scrap auto upholstery leather donated by an automotive company.

* * *

Engines for more than 6,000 heavy bombers, totaling nearly 30,000,000 horsepower were produced by a single automotive concern during 1943.

* * *

All proving grounds operated by the industry for field-testing of peacetime vehicles have been turned over to military services for war vehicle testing.

* * *

One of the largest automotive companies has 75,000,000 square feet of floor space devoted to war production, and another has teamed up with 18,735 subcontractors and suppliers to accomplish its war production job.

* * *

A testing machine developed by an automotive concern has reduced the rejection of anti-aircraft shell fuses from 20 per cent to one-tenth of 1 per cent, virtually eliminating "dud" shells.

* * *

An automotive plant has been forced to make fingernail polish and long fingernails worn by women workers taboo on the job, after it found these styles might transmit foreign particles into the delicate mechanism of the aircraft detection devices being produced.

Femininity no handicap in handling today's modern trucks.

Women Truck Drivers Demonstrate Their Skill in Keeping War Freight Moving Over Highways

ONLY yesterday, a typical housewife thanked her lucky stars if she could get the family car down to the corner store and back into the garage without denting the fenders or scratching the paint.

Today, that lady has a daughter who blithely pilots an 18-ton truck loaded with war materials through heavy traffic, between cities and into loading terminals. Not only that, but Army transport officials and civilian trucking concerns speak approvingly of her abilities.

The fact is that girls, like their brothers, are growing up in a mechanical era, and early in their teens are becoming familiar with the principles of vehicle operation. The notion that women of today are poor drivers or that they have a higher accident rate than men is not borne out by the factual data, according to highway and traffic specialists.

"Women are safer drivers than men," says a young woman, who herself is employed as a license examiner by the Virginia State Police. She is one of the first to hold such a job in the U.S.A. She thinks that women truck drivers, until they acquire experience, may be inclined to misjudge distances when backing and turning, but can soon learn.

And in spite of the fact that women are usually more "high-strung" than men, this woman examiner finds them decidedly more careful at intersections and other dangerous places where accidents most frequently occur.

Merry-Go-Round Fixture Speeds Output of Bombers

NO MUSIC peals out, but a merry-go-round is operating in an aircraft factory of the automotive industry.

This "merry-go-round", however, is not the type that delights the kids. It is saving time in the building of floors for the pilots' compartments of Liberator bombers.

Automotive engineers devised the circular arrangement in order to apply the progressive assembly method to the part which passes through many operations before it is complete.

Thirty platform cars move from station to station around the oval track, each car carrying a floor in varying stages of completion. Fastened in by special fixtures, the floors pick up controls and furnishings. When the circuit has been completed, a new floor is started on the car and the trip around the track begins again.

Automative engineers find war use far pin-ball mechanism. (See column 3.)

Work of Cheap Jap Labor Cannot Compete with Quality Guns Made by Machines

JAPAN'S wartime brand of bargain basement merchandise is not competing with the American-made quality product, according to Maj. Gen. G. M. Barnes, in a recent comparison of weapons used in the Pacific war.

So badly outclassed are the Nipponese weapons that Japan has been forced to change its most universal war product, the infantry rifle, whose effective range was far short of the guns used by American troops, the Chief of U. S. Ordnance development section points out.

Always a quality producer of civilian products American automobile industry has been able to take precision guns and instruments and turn them out on a mass production basis—giving our fighting men the best possible weapons in tremendous quantities.

The secret, of course, is the application of the principle of standardized parts to afford complete interchangeability, and in the breaking down of the manufacturing process into steps so simple that each can be handled by an unskilled or semi-skilled worker.

The popular conception that an assembly-line product cannot possibly be as good as a hand-made article is disproved. An automotive plant that is manufacturing gyro-compasses, formerly made by highly-skilled artisans, has unskilled workers on the assembly line turning them out in quantity.

Improvement in quality often comes through engineers wise in mass production methods who have been trained to do intensive work on each of the component parts of the article being manufactured. Their research will usually embrace both design and material, with innumerable tests to reveal how each part wears in relation to the whole.

Recently it was reported that such experimentation had multiplied many times the firing life of the 20 mm. automatic aircraft cannon, which is one of the most effective Allied weapons. Of European design, the gun is a very delicate and complicated mechanism, formerly produced only by highly skilled craftsmen working by hand, until an automotive war plant adapted its manufacture to the assembly line.

Research of this plant's engineers left them dissatisfied with the durability of the gun, which could seldom withstand 500 rounds of firing. Searching for breakdown causes, they took guns that came off the assembly line and fired them until they gave out, then took them apart to discover which parts had worn out first. In this way they determined what parts needed to be strengthened through changes in design or in material, until by improving the weakest parts they were able to prolong the gun's life.

For example, the life of the gun's firing pin, which is only one of twelve critical parts improved by the experiments, has been increased approximately nine times. The life of the receiver slides was increased 694 per cent, and of the driving spring, 483 per cent.

Not only was the resulting gun more durable, its cost to the government was reduced, as a result of this experimentation, to half the original price.

Even Pin-Ball Machines Have Gone to the Wars

Tricky Problem Solved By Salvaging Parts

NECESSITY, the time-honored mother of invention, has called forth many outstanding examples of human ingenuity since Pearl Harbor, but none have been more extraordinary than the stroke of inspiration which placed pin-ball machines in the service of the war.

Recently the Navy department ordered a quantity of electrical generators from an automotive plant. They were large 60 to 100 kw units, weighing up to 2,400 pounds each, and containing armatures covered with baked varnish. While planning their manufacture, the company's engineers found that a huge baking oven would be needed, but that some armatures would need to be baked longer than others.

They searched for a mechanism that would regulate the conveyor in the oven so that each armature would reach the oven door at the end of the right amount of baking time. The design and manufacture of such a mechanism would have caused a delay of months so an adaptation of some existing contrivance was necessary.

Then the engineers thought of the gaily-decorated and brilliantly lighted pin-ball machine, and recalled that there is a "ratchet relay," an electric timing apparatus controlling the recording of score and the lighting inside each machine.

Obtaining a number of confiscated pin-ball machines through the police agencies, they salvaged the "ratchet relays" in only a few days and mounted them on the armature baking ovens in the service of the war effort. They are reported to be scoring high marks for victory still.

AUTOMOTIVE
WAR PRODUCTION

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Tooling Provides Foundation for Mass Production

From assembly lines of an automotive plant, Liberator bombers prepare to takeoff for battlefronts.

Investment in Machines, Jigs and Fixtures Proves Sound When Volume Output Is Needed

THE results of two years of wartime operation — results visible in terms of armored divisions thundering against enemy strongholds, PT boats smashing enemy invasion fleets, and airplanes cascading death and destruction across three continents—have proven in trial by fire that the formula by which the automotive industry operates is both sound and sufficiently elastic to meet any emergency demands.

In the words of the 18th century poet, Alexander Pope, today's vast automotive war production machine is "a mighty maze, but not without a plan." To automotive men with 42 years of production and 86,000,000 vehicles behind them, the plan is a simple and logical combination of calculation of cost, projection of method, and engineering, combined with the most efficient use of manpower and machine power in the same relative quantities in which they were used in peacetime.

The application of mass production principles to the industry's $30 billion in war contracts, while an exacting and difficult task, was never considered an insurmountable objective. The results of that application today are measured in terms of bombers and fighters, shell and shot, tanks and cannon and almost 300 other types of war goods produced. They bear out the solid belief of industry in methods which had been hardened by the fire of keen individual competition.

In recent weeks a relaxing of censorship regulations has enabled automotive companies to release production data, high-lighting the fact that automotive methods are proving just as efficient today as they were in peacetime.

"The second thousand (bombers) has come along much faster than the first—and a third thousand is on the way," one company's War Department approved report stated recently. This was within eight weeks after production of the first thousand bombers had been completed.

Another company revealed that 22,925 aircraft engines for Flying Fortresses had been produced in 1943, nearly four times greater than the output of the previous year.

When a single company announces the production of over 33,000 engines for Liberator bombers since the war began, and states that three-fourths of these were manufactured in

(*Continued* on *Page* 2)

Automotive conveyor lines speed output of wings for fighting planes.

Industry's Tooling Methods Prove Sound

(*Continued from Page* 1)

the past 12 months, it is a significant commentary on the heavy acceleration of production which becomes possible once the groundwork has been laid and assembly lines begin rolling.

One of the basic reasons for this tremendous productivity is the industry's system of tooling techniques, methods resulting from a continuously evolutionary process which functioned at top speed during two decades of quantity production of cars and trucks. Behind these techniques was the driving urge to "do it better—do it quicker —do it oftener."

Tooling up for a war job (i.e. providing the special jigs and fixtures that hold tools and parts in proper position while the operations are being performed) is an expensive and time-consuming task. By so doing, however, the work is greatly simplified and interchangeability of parts is assured. The resulting output and efficiency rises to levels which far outweigh the initial consumption of time and expenditure of money.

The extent of initial outlays is determined by the requirements for the end product. When an order is multiplied, automotive practices dictate a shift from general-purpose machines to expensive but speedier special-purpose machines. The same is true of the housewife who uses a broom when she has only a little sweeping to do, but buys a vacuum cleaner when her work increases.

It would be a questionable practice, for example, to do any considerable tooling if, say, the Army placed an order for only 100 machine guns. These could be built and delivered with the basement-type vise and tools long before specially-designed jigs and fixtures—far more costly than the total price of all the guns—would leave the tool shop. On the other hand, if a million guns were needed, the most efficient of tooling methods would be warranted. Otherwise, it would probably take ten years to fill the order with existing facilities, and the price of the guns would be prohibitive.

The value of tooling for mass production is shown in the case example of a crankcase for one company's aircraft engine, whose output schedule was revised upwards three times.

The original small daily output schedule was met with a minimum of tooling, although each crankcase required 230 direct labor hours, and spoilage averaged 47.6 per cent.

With the first big increase in production—an order that nearly tripled the daily output—the company quickly mechanized the crankcase operation. Thirty-two new machines were purchased. along with their accompanying jigs and fixtures. Instead of 230 hours manufacturing time, only 125 hours were required for each crankcase, while scrappage was reduced to less than 7 per cent.

Tooling refinements and expansion kept pace as production schedules were later doubled, and then doubled again. Efficiency, too, continued to increase. Labor requirements dropped first to 40 and finally to 32 hours, while scrap eventually reached the low point of less than 4 per cent.

Meanwhile, the application of the standard automotive production formula caused similar changes to be made throughout the entire plant.

Two specially designed boring mills were installed to accomplish simultaneously 18 operations formerly done individually. Production was increased 92 per cent, nine regular boring mills were made available for other work, and seven skilled craftsmen were able to take on other tasks. Total production time per engine was cut in half and scrap declined 80 per cent.

Coming steadily to the fore, after many months of work and millions of dollars spent for tooling, one automotive company today is the world's largest producer of heavy bombers. Rate of efficiency per man in the plant, according to the War Production Board, increased 40 times during the past year.

A special fixture for assembling the mammoth center wing section of the bomber is one of the reasons for the increase of efficiency, and is also a classic example of the application of proven tooling methods designed to achieve volume production. It replaced a knock-down fixture that had to be set up for each new job and then dismantled so the part could be removed. Thirteen days were required to set up the fixture, assemble the wing, and remove it.

Today, a huge permanent fixture has been installed, which enables the wing, when complete, to be lifted out of the top by crane and carried to the next operation. Time requirements for just setting up the fixture have been reduced from 250 manhours to just 60 minutes. For the actual construction of the entire wing. total manhours have been reduced by 94 per cent.

The addition of 16 conveyor lines to production of wings for Thunderbolts and Flying Fortresses at another plant in the automotive industry are saving 185,660 manhours per month. In addition, 796 badly needed workers were shifted to other assignments.

Industry Commemorates Peacetime "Burial" As 2-Year War Deliveries Top 14 Billions

FUNERAL services for that peacetime giant, the automobile industry, were held two years ago this month.

On February 10, 1942, the last passenger car rolled down the line. Even as it was being assembled, other workmen were uprooting heavy machinery, tearing out conveyors, and cleaning out plants. Conversion, which now finds 1038 of the industry's principal plants devoted 100 per cent to war work, was in full swing.

Reporting the event, one newspaper commented: "America has just scrapped its biggest industry. Except for war purposes motor-car manufacture is as out-of-date today as the manufacture of whalebone corsets."

In the two years that have elapsed, the industry's actual war deliveries have amounted to $14,200,000,000.

Today the industry is turning out aircraft, tanks, military vehicles, guns, marine equipment, ammunition and a host of other items at an annual rate in excess of $10,500,000,000. Two years ago war product deliveries amounted to $2,300,000,000 annually.

To accomplish this feat scores of new plants were built, the nation's sub-contracting facilities were utilized to their fullest extent, and hundreds of thousands of workers were added to automotive payrolls. In addition, manufacturing and processing methods were improved; new techniques and short-cuts were devised, which have enabled the industry to make price reductions and voluntary refunds to the government amounting to $2,000,000,000.

In the two-year period, aircraft has risen to the No. 1 position in the automotive industry's production program, accounting for 42.4 per cent of the industry's employment and $5,030,000,000 of the gross deliveries. This is equivalent to an "invasion day" air armada of 194 squadrons, each consisting of 15 heavy bombers and 30 medium bombers, and each with a protecting cover of 90 fighter planes.

It would take 174 armored divisions each equipped with 3,314 vehicles and tanks to equal the volume of equipment produced in these categories. During the two-year period, military vehicles and parts have accounted for $4 200,000,000 of the total figure, and tanks for $1,900,000,000.

The production of guns and parts totaled $1,150,000,000, which is equal to 15,000-90 mm. anti-aircraft weapons and 465,000-50 calibre machine guns.

It would take a fleet of 2,000 sub-chasers and 2,154 motor torpedo boats to equal the value of marine equipment turned over to the armed forces. In the two-year period deliveries in this category have amounted to $1,020,000,000.

The $500,000,000 reported as the value of the ammunition delivered is equal in value to 15,000,000 anti-tank shells, 7,750,000 trench mortar shells and 625,000 demolition bombs weighing 1,100 pounds each.

Other war products, a list extending over 300 different types of items, made up the remaining $400,000,000 in deliveries.

Tanks and parts production utilize 15.5 per cent. of the available manpower supply. Military vehicles and ammunition production each required 4.1 per cent of the total workers on the industry's payrolls, and the manufacture of guns larger than 20 mm. took 3.8 per cent.

Making possible this production achievement has been the efforts of over 500 large and small automotive manufacturers, located in 31 states. Supporting their effort have been subcontractors of every size and description located in 1,375 cities in 44 states. The work of this chain of subcontractors has been an important part in the industry's war program, since they furnish parts and subassemblies for as much as 98 per cent of a finished product—as in the case of the aerial torpedo.

That the continuous flow of war materials from source to subcontractors and then to the final assembly line was so smoothly accomplished is due in large measure to the nationwide system of motor transport whose operators have met every demand, despite shortages of vehicles, replacement parts and skilled personnel.

AUTOMOTIVE WAR PRODUCTION

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Automotive Council for War Production

HARRY A. WILLIAMS, Editor

New Center Building, Detroit, Michigan

Farm Mechanization Boosts Food Output

THIS is a war of horsepower, not only on the fighting front, but on America's farms. For without mechanical horsepower the feeding of 11,000,000 men in uniform and the 10,000,000,000 war plant workers at the lathe and the mill would be an impossibility.

In contrast to agricultural conditions at the time of the Napoleonic wars when it required 19 peasants to feed themselves and one additional person, today the typical American farmer feeds four non-farming persons.

Last year, each farm fed six more persons than it did in 1919, an indication of the extent to which motor trucks and tractors have stepped up the producing ability of the farmer between the two world wars.

The bright chapters in the history of man's struggle for food are of recent date, and are attributable mainly to the application of first horsepower then automotive-applied power to tasks which agricultural workers for centuries did through the hardest kind of work.

Up to the early 19th century, agriculture was carried on much as it had been for 500 years. The agricultural worker was accurately and realistically portrayed by such paintings as *The Man With The Hoe* (see illustration), which prompted American poet Edwin Markham to exclaim that the farmer wore "the emptiness of ages in his face, and on his back the burden of the world."

But even as Markham was writing, the mechanical revolution of American farms was freeing the agricultural worker from his age-old bonds, and was putting thousands of units of horsepower at his beck and call.

Beginning with 1831, the center of progressive agriculture shifted to America as the reaper was placed on the market, followed by the mower and threshing machine three years later. In the 1840's came grain drills to speed planting, and by the end of the decade the time required to harvest an acre of wheat had been reduced drastically. It now took only 11½ hours as compared with 37 hours.

This machinery, drawn by horses and mules, made possible the cultivation of greater acreage, and with the westward development of the railroads it became possible to move grain in huge quantities to Eastern cities.

The immortal petition from the Lord's Prayer, "Give us this day our daily bread," still held more than a religious meaning for the farmer, however, although he was becoming daily less subject to the crushing forces which had bowed down his predecessors. As the growth of industrialization and large cities transformed agriculture into a business, the study of weather conditions, farming methods and pest controls was encouraged. Soon the American farmer began to realize a growing amount of return from his efforts.

The discovery of oil in Pennsylvania in 1845 gave impetus to the development of the internal combustion engine, and interchangeability of parts was discovered.

Agricultural production increased steadily under the impetus of continuously better machinery and greater demand throughout the remainder of the 19th century.

During World War I, the annual production of wheat rose to a new high of 952,000,000 bushels and farm income doubled to reach $17 billion annually, even though the armed forces and war industries had taken more than a million men from the farms.

Shortly after the turn of the century, the infant automotive industry had begun to apply its newly-learned skills to the problem of farm motive power. One of the first automobile makers, a pioneer in the development of mass production of low-priced cars, attacked the problem in 1906 and again in 1908, but was dissatisfied with his efforts and turned again to automobiles. But he continued to experiment on the farm tractor.

Another company, a pioneer in the farm equipment field, was not content with production of the reaper, which its founder invented. It turned to farm tractors and motor trucks, to help the farmer with his cultivation and distribution problems. Other producers confined themselves to the tractor field and by 1914 there were 10,000 farm tractors in use throughout the United States.

During World War I most of the

farm motive power was provided by 26,000,000 head of horses and mules, and it required the production of almost 100,000,000 acres of harvested cropland to feed them. By 1918 there were 85,000 farm tractors in use, but the following year there were 158,000, and the tractor bad truly become the power behind "the plow that broke the plains."

Down through the years following the armistice, the trend toward farm motorization continued. Since 1900 more than 8,000,000 people have moved from farms to the cities, and though in 1880 70 per cent of the population lived on farms and 30 per cent in cities, that figure had been exactly reversed by 1943.

Through industrial progress the number of persons gainfully employed has increased tenfold since 1840, reaching 50,000,000 by 1942. Food demands meant more power farming, and in 1941, 358,523 farm tractors were produced. Since 1913 the number of power driven plows, rakes, harrows and similar implements has increased 112 per cent and the number of motor trucks increased 450 per cent. Meanwhile the price of the tractor fell 40 per cent, as mass production made it available to farmers generally.

As machinery raised the crop production per worker, while its cost declined, machinery began to look like a better investment, and a buying trend through 1943 resulted in 1,900,000 farm tractors being placed in use in this country alone. The 1942 farm crops of the nation were harvested with 26,000,000 fewer persons than would have been required if 1840 methods were still in general use.

The farmer began to realize that it requires 5 acres of land to provide feed for a single horse, and that a tractor will replace 2.8 horses and save a farmer 30.7 man days of work, a full month, in a single year. As a result, the farmer purchased over 7 million power units to do his work—1,900,000 tractors, 4,200,000 automobiles and 1,100,000 trucks, and thereby raised the production per worker 50 per cent over the 1914 level.

Translated into terms of farm labor saved, this growth of automotive power means that in 1830 the peasant portrayed by Millet required 64 hours and 35 minutes to produce an acre of wheat. Today by using tractor-powered machinery and by hauling by motor truck only 2 hours and 24 minutes are required. In 1855 it took 38 hours and 45 minutes to produce an acre of corn; today it takes five hours and 21 minutes.

Cars and trucks assist farmers in meeting their wartime assignments.

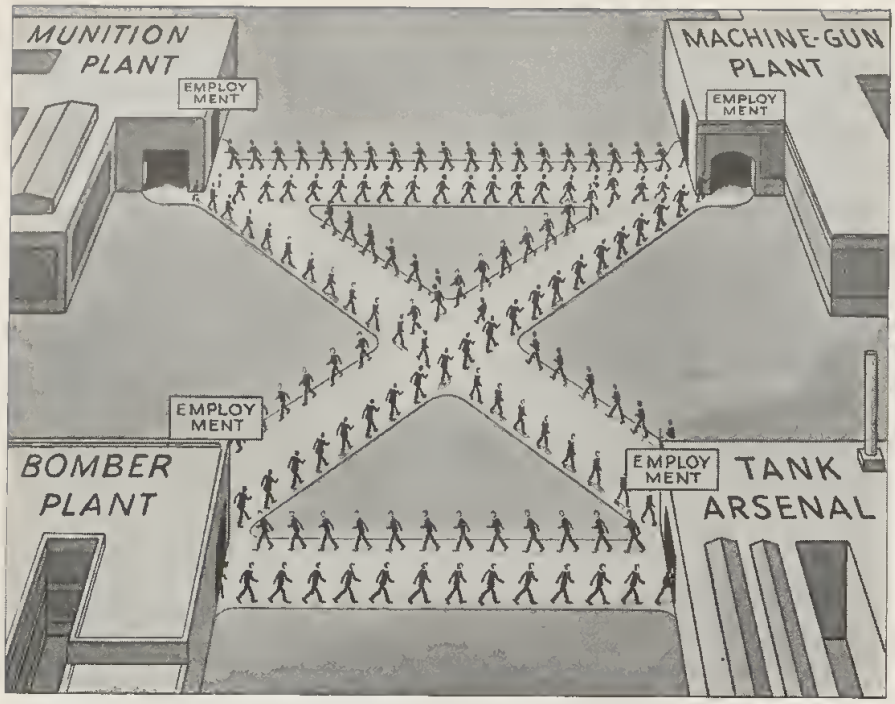
Last year each farm fed six more persons than it did in 1919, and the income per person on farms was 22 per cent greater. The increased income and lowered working time meant for the farmer more time for education, for social and religious contact, for participation in the duties of citizenship, for strengthening the ties that bind the family .

As motive power has been increasingly harnessed to meet the needs of the farmer, so has the farmer's horizon broadened. He has ready access to schools and churches, a wide variety of shopping facilities, to doctors and hospitals when needed, to libraries and educational centers. In fact, he is able to take advantage of nearly all of the cultural and social opportunities of his time.

The motor truck allows him to grow perishable commodities, to take them to markets where satisfactory prices exist, and to cultivate lands which were formerly too far distant from markets for produce.

Before the coming of the motor truck nearly 50 per cent of the perishable farm produce never reached metropolitan markets because the grower was too remotely situated. Today 90 per cent of America's apple and vegetable farmers own trucks, 85 per cent of the nation's farm families own cars, and the population in the rural areas of the country own 68 per cent of all motor trucks and 38 per cent of all passenger cars in operation.

A single tractor does the work of nearly three horses, saving 30 days a year.



Company Conducts Interviews-in-Reverse To Combat Practice of Frequent Job-Changing

"MY *husband won't let* me *work in that department. . . .*"

"I don't have any way to take care of the children. . . ."

"I want my old job back; I don't like the new work. . . ."

Day after day trained personnel specialists of one automotive company listen to long lists of such reasons from people who want to quit their war jobs. Their purpose is to persuade them to go back to work.

Hidden in the deep pools of the human mind and temperament are the *real* reasons why people quit—some minor irritation, some source of friction, some personal inconvenience.

The job of the "pre-clearance interviewer" is to probe into the deep recesses of human psychology to ascertain the actual reasons, so that corrective steps can be taken. Established several months after Pearl Harbor, this special department has developed some unusual techniques for dealing with the labor turnover problem. Today, approximately four out of every ten employes who want to quit are induced to stay.

Looking at it another way, the company estimates that its present average monthly quit rate—based on the number of employes who want to change jobs or retire from industry—has been reduced to around 1.5 per cent, seventy per cent lower than the nationwide average.

All of these results do not, however, tell the full story of the plan's value to the company. For often the department has uncovered plant conditions which can be improved, thus contributing to better worker efficiency and morale. An important by-product of the department's work has been the cutting down of the number of persons wanting to quit.

Under the plan, a worker who wants to leave the job is allowed to check in his tools and to turn in gasoline ration books; but before receiving his "quit slip" and final pay he is asked to visit the Pre-Clearance Department. Here one of the specially-trained interviewers makes every effort to learn the real story behind the employe's decision.

In the privacy of a closed office, workers quickly relax and talk freely about their problems. Once in the open, it is generally easy to figure out a solution.

Recently a woman with two children quit because she was included in a large group of employes being changed from a late to an earlier shift.

On the late shift it was possible for her to be home in the morning in time to get the children off to school. In addition, she was able to take care of the housework and prepare food for canning.

The interviewer called in the department foreman and explained the case. Changes were made in the list of employes to be transferred, making it possible for her to continue war work.

Returning late from a leave of absence, an old-time employe found someone else at his machine. He refused a different job and announced he was quitting.

In the Pre-Clearance Interview Department the employe heard an explanation of the situation. When it was pointed out that the long absence made it necessary to break in a new worker; and when an offer was made to place the employe on work similar to the old job at the first opportunity, the worker agreed to stay.

In another case a middle-aged employe, who came to work to help the war effort, complained that running a machine was too confining. A farmer, who had led an active life, the employe said the job "got under his skin."

Arrangements were made by the interviewer to transfer the worker to the Receiving and Shipping Department as a stockchaser. This provided plenty of opportunity to move about the plant and satisfied the desire for activity.

Then there was the woman employed in the plating department for only three days who decided to leave. She explained to the interviewer that her husband, an employe of the same plant, had told her the job was injurious to her health. Both husband and wife were invited to inspect the department with the interviewer. Special care was taken to point out safeguards. Both admitted their mistake and the woman returned to the job.

And another similar case was presented by a young woman inspector, who upon being transferred to a machine operating job, refused to make the change because she had been warned that such work was dangerous. Taken into the plant by the pre-clearance interviewer, she watched other women doing this type of work. Stopping at one machine she discussed the work with the operator and eventually tried her hand at controlling it. Convinced that the job didn't involve any safety hazard, she willingly agreed to accept the transfer.

Competitive Spirit Stimulates Progress

Results in Better and Cheaper War Products

THE vitality and versatility of the American system of competitive business enterprise was demonstrated again recently when an automotive concern announced that at the conclusion of two years of war work it had been able to refund $900,000,000 in voluntary price reductions to the government.

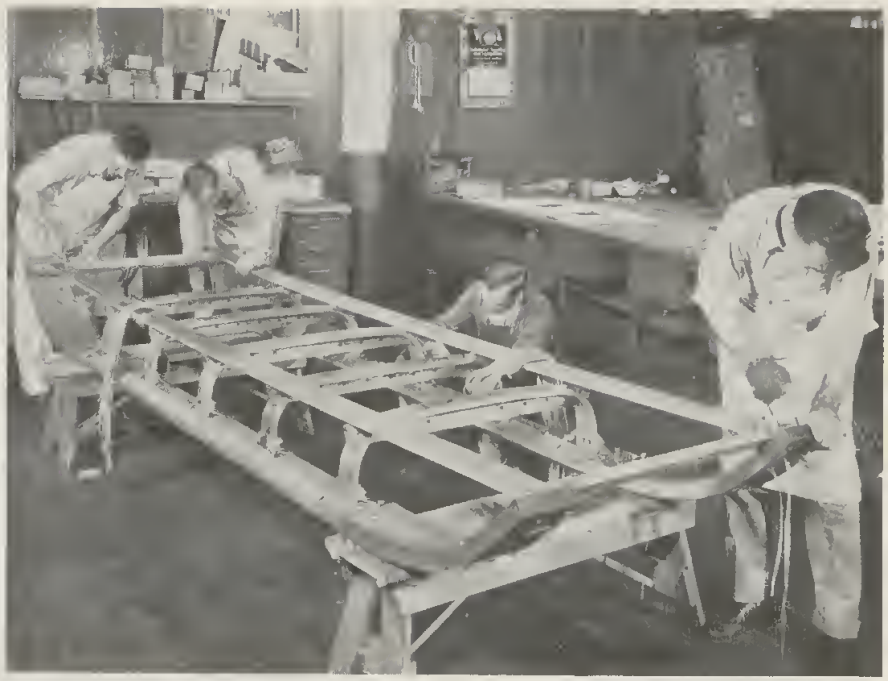
Coming in the wake of 1943 year-end estimates that over $2 billion in arms costs had been saved by automotive companies alone through price reductions, new techniques and manufacturing efficiencies, the announcement of this huge saving underlines the extent to which the nation has benefited from the fierce competitive spirit fostered throughout the automotive industry over the past 40 years.

Shortly after the declaration of war, when automotive producers met and unanimously agreed to pool information and engage in cooperative fact-gathering and collective study of methods, there came a halt to competitive enterprise in the peacetime sense.

There remained, however, the competitive spirit, and it became transformed into a form of rivalry between automotive producers who formerly tried daily to outguess one another but were now concentrating on outguessing the best minds in the Axis industrial setup.

The only one who could gain was the industry's only customer, Uncle Sam, and it was not long before tangible gains were on record. One company saved $16,000,000 in the manufacture of gun carriages and aircraft cannon, another reduced by half the cost of anti-aircraft guns, and a third cut 37 per cent from the cost of airplane wings.

To date this rivalry has saved billions, and will save additional huge sums as long as war production is topmost in importance in the nation. With peace, the buying public can expect to gain the profits now going to government. For wartime rivalry will again become competitive enterprise, with the resultant volume production of better products at lower costs.



Skills of Carriage-Making Days Are Revived To Provide Sleds for Snow-Bound Fronts

KIDS are not the only ones dragging sleds to the nearest snow-covered hill for a go at coasting. The Army too is bringing out its sleds, 150-inch models for use on snow-bound battlefronts.

To meet this need, the Army turned to an automotive company which had available a reservoir of woodworking specialists, who had acquired "know-how" of the art in the days when automobile bodies were made of wood.

Manufacture of the 290 pound sleds posed a unique wartime production problem to the industry. Rawhide knots had to be substituted for bolts, a practice previously followed in dog sleds but seldom applied to vehicles of this size.

Purpose of the design, engineers explain, is to avoid having ball heads snap under strain in sub-zero temperatures. Further, the binding of slats to bows and bows to seven-inch wide runners affords a certain flexibility. The runners will thus follow curves behind a tow car, whereas solidly attached runners will skid.

It was also necessary to perfect a method of making the 83 knots substantial. These had to be tied from rawhide strips, made pliable—and consequently slippery—by soaking. As eventually worked out, production crews developed specialists who concentrated on tying the different knots required for the binding. As a result, assembly time on the sleds has been reduced by more than half the time required in the original period.

Packing Improvements Save Shipping Space

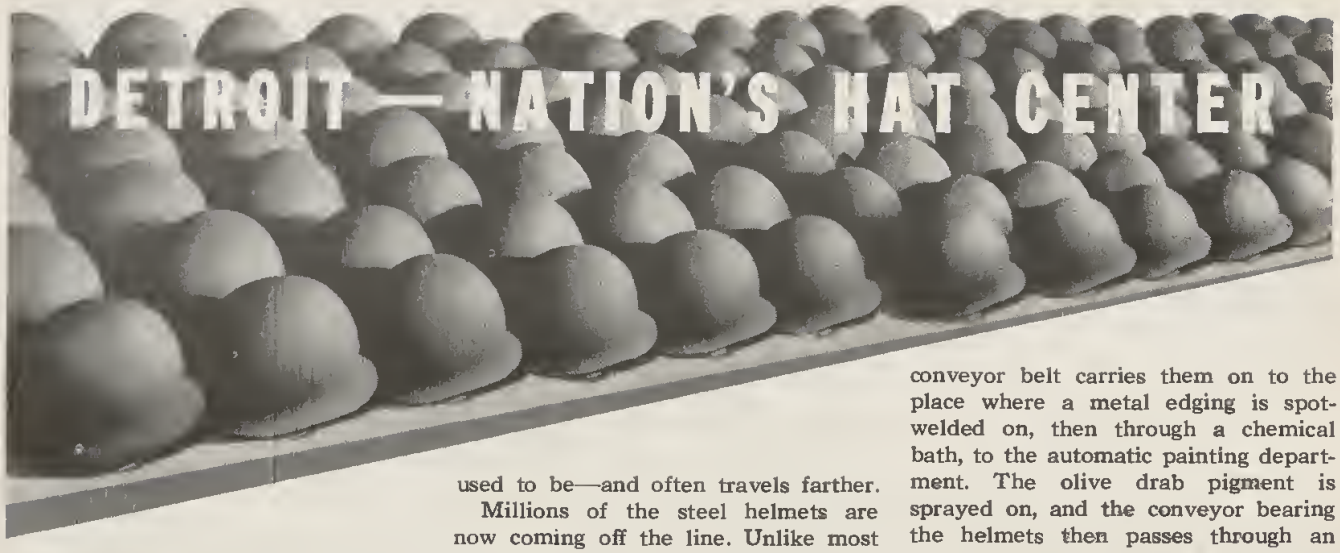
HIGHLIGHTED by the current rush to get supplies across the Atlantic for the coming invasion is the work of automotive engineers in the past few months to conserve every available square inch of shipping space.

One automotive company, for example, recently revealed a reduction of 55 per cent in the measurements of its disassembled truck crates. Previously, each knocked-down chassis and cab occupied 878 cubic feet in a transport's hold. Today, the same unit has been compressed into 389 cubic feet.

The chief revisions involved detachment of axles from frames and a twin-unit pack. Three smaller crates were designed to replace the two larger ones previously used.

Upon arrival at their overseas destination, these vehicles are quickly assembled by skilled workmen and dispatched immediately to the point where they are needed most.

DETROIT — NATION'S HAT CENTER



DETROIT is paging Lily Dache, to tell her about the latest in hats—an "invasion chapeau" that stays neat and trim even when it rains. In fact a downpour of bullets and shrapnel, even bullets at point-blank range, are just what it is made to withstand.

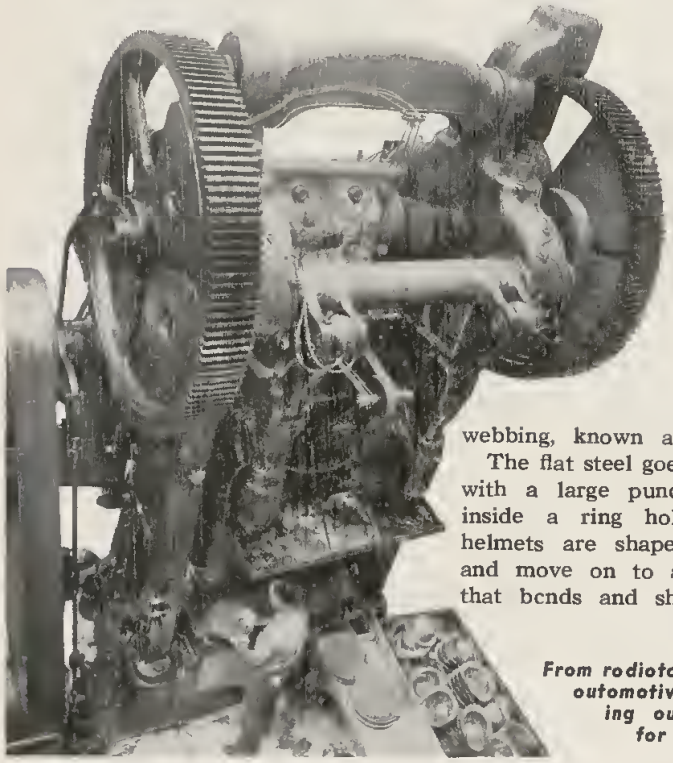
The lady who whisks into being "half-hats" and nameless numbers out of odd bits of ribbon, flowers, chicken feathers and other trifles, might be interested to know about the largest hat-making industry the world has ever seen. She might be surprised that in Detroit the wartime bonnet-with-chin-strap is turned out on an assembly line basis, the way automobiles and trucks used to be—and often travels farther.

Millions of the steel helmets are now coming off the line. Unlike most hat creations they are as similar as the quintuplets. But they take a lot of fasbioning and fine workmanship just the same.

In one automotive plant giant presses stamp the helmets out of the manganese steel, tested to meet Army specifications as to hardness and toughness. The metal is so tough that it's hard to draw into shape on the press. In fact, it's the same steel that's used for railway switches and for plowshares. Some said you couldn't fashion a helmet out of stuff like that. But the engineers did it.

There were scores of problems to decide: how deep to make it. The tin hat of the World War was too shallow, too flimsy, set too high on the head to be a protection in hand-to-hand combat. The new helmet covers a man's head down to the ears, yet rests comfortably and lightly because of its specially designed inside webbing, known as its "suspension."

The flat steel goes into a giant press with a large punch die that works inside a ring hold-down die. Two helmets are shaped at each stroke, and move on to a "spanking" press that bends and shapes the visor. A conveyor belt carries them on to the place where a metal edging is spot-welded on, then through a chemical bath, to the automatic painting department. The olive drab pigment is sprayed on, and the conveyor bearing the helmets then passes through an infra-red ray oven where they are dried. Women at sewing machines then stitch on the chin straps. From start to finish there are 27 operations, and it takes exactly 22 minutes to turn a flat piece of stael into the latest style hat.



From radiators to helmets: Giant automotive press now stamping out armor-plate hats for U. S. armed forces.

A woman picks her new creation by intuition. But the man in the foxhole has his hat picked for him. Before he gets it, it has to stand severe tests, such as withstanding a 45 calibre bullet fired at six-foot range.

Self-reliant and inventive as he is, the American doughboy has probably put the helmet to more usas than its designers ever thought possible. Recently, a list of 38 different uses was compiled, covering everything from a pan for boiling eggs to a machete for swinging on the enemy's necks during commando raids.

DO YOU KNOW?

A method of X-raying high stress aircraft engine parts in mass quantity has been developed by an automotive company. Used to inspect important castings, the new X-ray machine has a capacity of two pictures per minute or one completely inspected tray, containing from one to 20 parts, every 30 seconds.

* * *

An automotive producer of tires converted to the production of anti-tank cannon and bullet-proof fuel tanks for warplanes and then reconverted back to tire making, all in the span of twelve months.

* * *

Substitution of plentiful coal tar for oil has effected a saving of more than 25,000 gallons of fuel oil daily at the plant of one automotive company.

AUTOMOTIVE
WAR PRODUCTION

Vol. III No. 3 | Published by Automotive Council for War Production | March, 1944

Internal Combustion Engine Meets Challenge of War

Automotive Engines Provide Unexcelled Power For Global Fighting on Land, Sea, and in the Air

NIGHT and day, America's No. 1 mechanical hero, the internal combustion engine, is blasting away at the enemy's stronghold from land, sea, and air in a mighty outburst of power.

A steady toiler in peace and a raging force in war, the internal combustion engine has taken on many new roles in this global conflict, powering a variety of craft from Ducks and PT boats, to jeeps and 400-mile-an-hour fighter planes.

Just as the cotton gin advanced the South, as the plow and reaper unrolled the prairies, so the internal combustion engine's development opened a new era—one in which Main Street was lifted out of the mud, distances were shriveled, and harnessed energies applied to many useful tasks for man.

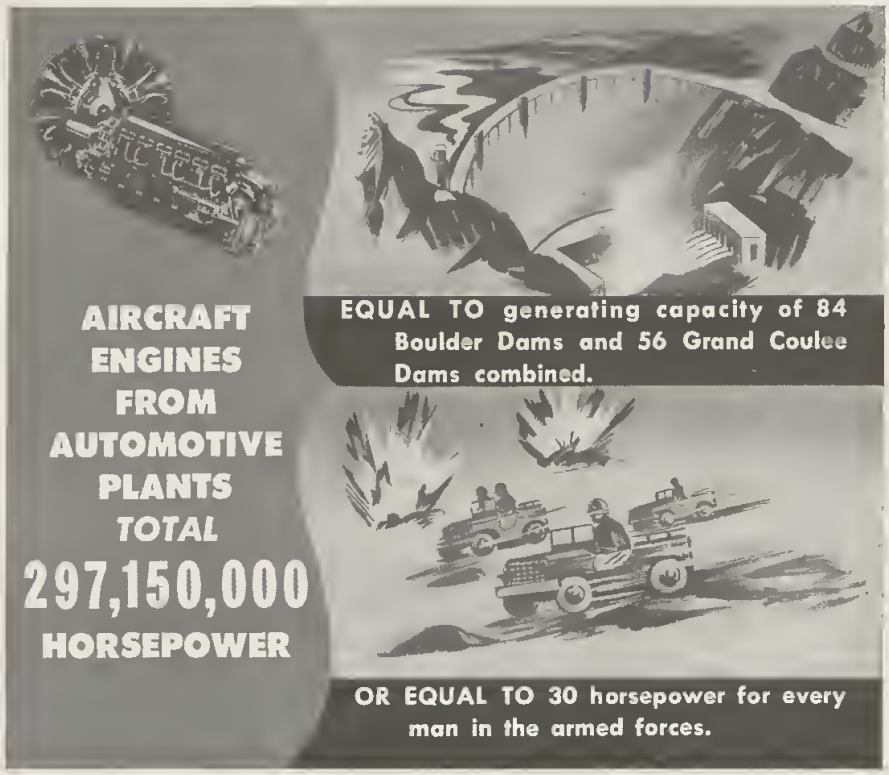
First patented in modern form by Nicholas Otto in 1877, and nine years later installed in the horseless carriage, the internal combustion engine began battling for real recognition near the close of the last century.

With each passing decade, it roared into new prominence, refined and improved by American automotive engineers, until 86,000,000 cars and trucks were put on the highways, 80% of the world's total. Its energy also drove farm tractors, sea going vessels, air transport.

Engines by the carload have rolled from automotive assembly lines since the war began. Ranging from small stationary engines to the huge power plants of the super-bombers and super-fighters now on the way, they are providing America's fighting men with unexcelled performance on land, on sea and in the air.

Horsepower potential of these engines, not available because of so many weapons still on the secret list, would be almost unbelievable. However, the 220,000 aircraft engines alone, that have been delivered by the automotive

(Continued on page two)



Automotive Engines Meet Challenge of War

(Continued from page one)

industry, represent the astronomical total of 297,150,000 horsepower. This is equivalent to the combined generating capacity of 84 Boulder Dams and 56 Grand Coulee Dams. Or, it is equal to nearly 30 horsepower for every man in the armed forces.

Automotive research and development in the Diesel type of internal combustion engine is mainly responsible for the startling fact that Diesel power now exceeds steam power in the United States Navy.

All of the four major type landing craft, so prominent in current battle-front dispatches, are powered by Diesels, 71 per cent of which are produced by a single automotive company.

The powerful gasoline engines of the Navy's sensational PT boats are an exclusive product of another automotive firm—a development going back to the Detroit River speed boat races.

Even the Army's reliable foot soldiers, the men of the infantry divisions, have 400,000 horsepower per division at their disposal. Representing an 11,000 per cent increase over the 3200 horsepower of the World War I infantry division, the mobility of today's infantry points up the progress that has been made by automotive engineers since the end of the last World War.

Though most of the refinements in the gasoline engine came between the two wars, many improvements were made as the automobile began catching the public fancy. In 1900 when less than 5,000 cars were sold, one company introduced a model powered with a one-cylinder five-horsepower engine. By 1910, average horsepower of cars had increased to 32, then jumping again in 1912 to 48.

As a result of road races to overcome prejudice against the horseless carriage, automobile racing became a new attraction for thrill-seeking, sports-loving Americans. Dirt tracks sprang up in various parts of the country and in 1909 the Indianapolis Speedway was built. Results of pioneering by race track drivers in striving for improvement to effect greater speed are being demonstrated today in the bombers that penetrate deep inside the defenses of the enemy, in the fighters whose speed and performance is unexcelled.

The prototype of the modern PT power plant was the famed Liberty engine of the first World War. Though only a few ever saw combat in France, these engines, built by an automotive company and sold by the government at the cessation of hostilities, contributed greatly to the refinement of the gasoline engine.

Research with Liberties resulted in the development of the turbo-supercharger, so vital to our pilots today, and, it led to the development of the liquid-cooled engines that power this war's Airacobras, Lightnings, and other types of fighter planes.

The current capacity in the automotive industry for producing wartime horsepower is traced to the constant expansion and improvement of manufacturing facilities in peacetime. As the automobile progressed from a plaything for the wealthy to a necessity for millions, mass production was needed to meet the increasing demands.

In 1914, more than a half million cars and trucks were turned out. Just two years later the industry reached for the first time an annual output of a million vehicles. The two million milestone was passed in 1920, the four million point in 1923, and the all-time high of nearly five-and-a-half million cars and trucks in 1929. Beginning with 1900, more than 86 million motor vehicles have been produced.

Military possibilities of the internal combustion engine as far as the U. S. Army is concerned first appeared when one automobile was ordered in 1903. Four more were purchased in 1906, and the first truck in 1907. Even slower than the public in accepting this new motive power, the Army's motorization at the start of World War I in 1914 consisted of 61 vehicles and 29 motorcycles.

The Mexican uprising in 1916 demonstrated the value of cars and trucks in military operations and by the time the United States entered the European war the Army was equipped with 3,039 trucks and 437 cars. During the 18 months of the war, the automotive industry produced more than 90,000 trucks and more than 18,000 cars for the armed services.

More than two and a quarter million military vehicles have been produced by the automotive industry since the present war began in 1939, demonstrating graphically the progress of transportation in the 25-year span.

The horsepower represented in these vehicles, combined with the automotive-produced engines for tanks and ships, planes and submarines, and the thousands of other wartime uses of the internal combustion engine, presents a staggering total. It adds authority to the recent statement of a high Army officer that "this is a war of motors."

Automative products shorten the distance between farm and market.

Farm Role of Motor Trucks Is Accentuated As War Needs Call for Greater Food Output

SINCE Pearl Harbor, the loud thunder of military events overseas has frequently drowned out the homely sounds of plowing and planting, cultivating and harvesting which accompany the production of the nation's No. 1 necessity in peace or war—food.

In the whirl of daily events, the presence of food to be purchased is considered only a normal circumstance, while its absence in any considerable quantities or types is greeted with strong language by the consumer. While the typical consumer ordinarily may show scant concern with facts about how food reaches the grocer's shelves, he is violently interested when, armed with ration coupons, he goes shopping and finds the shelves bare.

American farmers, using over 7,000,000 motor vehicles, tractors, trucks and automobiles, produced record-shattering crop totals in 1943. The production of meat over 1942 was increased 13%, of poultry, 22%, of eggs, 13%, and of potatoes, 25%, but this year he is being asked to plant 16 million additional acres to supply the United Nations with mountainous supplies of staple foods.

Last year's crop totals would not have been possible without the extensive use of mechanical power. The 1944 crop quotas call for even more intensive exploitation of the millions of horsepower in the farmer's 7,000,000 vehicles, and for more efficient use of food distribution trucks, if the goods are to be brought to market without spoilage.

The motor truck must be the unbreakable link in the chain connecting the farmer, meat packer and food processor with the military and civilian food markets. More than 54,000 communities, 43% of all the nation's communities, depend entirely upon highway transportation, and 93% of these communities are in rural areas.

Their dependence on the motor truck is demonstrated by a survey of 15 typical rural Midwestern counties, where it was found that trucks delivered 100% of the eggs and poultry, 98% of the beverages, 97% of the fruits and vegetables, 96% of the meats and 70% of all other farm commodities.

The dependence of metropolitan areas on food brought by truck from rural districts is shown by a survey revealing that trucks brought 92% of the eggs consumed in Los Angeles, 67% of those used in Boston and 66% of those delivered in Chicago. Twenty of the nation's largest cities receive 100% of their milk via motor truck. Chicago receives 54% of its butter by truck, and San Francisco receives 52%.

Over 81% of the fresh fruits and vegetables marketed in Los Angeles are brought by trucks, as are 66% of those received in San Francisco. The nation's stockyards report that more than half of all livestock receipts are by truck, and it is estimated that 95% of all livestock are trucked initially from the farm to either stockyards or loading pens.

The phenomenal growth of transportation of food and farm commodities by truck is indicated by a comparison with the years prior to World War I.

In 1916, trucks carried only 1.7% of the "little pigs that went to market," but last year they delivered 74% of all hogs received in major livestock centers. In 1916 trucks transported only 4.1% of the calves and 1.3% of the cattle, but by last year the percentage had grown to 70% and 66% respectively.

The speed, flexibility and economy of truck delivery have had marked effects on the food supplies which are so important to the nation's wartime economy. Distribution of seasonal crops over a wide area is now possible—50 different kinds of fruits and vegetables are distributed from a single Florida market via truck to 26 states, ranging from New Hampshire to Kansas.

Food waste is reduced greatly through truck flexibility, because it is now possible to ship truckloads of foods into isolated mining, lumbering and similar areas which are not served by railroad and which never before had the opportunity to purchase some fresh foods. Similarly, food products of the warm south arrive in northern cities by truck to lend diversification to usual winter diets.

In conjunction with mechanized farm equipment, motor trucks have played the leading role in making the farmer a low cost producer, able to offer his meats, dairy products, fruits and vegetables to consumers all over the country. In turn, the availability of these foods far from their sources has greatly increased the demand for them as consumers became accustomed to their presence. The demand for some citrus fruits has risen 1,000% in certain areas since trucks first began to transport them in quantity.

BLASTING THE LOG JAMS

With Cooperation the Keynote, Weapons Flow Steadily From Automotive Assembly Lines to World's Battlefronts

By Pooling Ideas and Swapping Methods Industry Accelerates Its War Deliveries

AS ANY lumberjack knows, it takes courage plus a heavy charge of dynamite to break up a log-jam and start the flow of timber on its way to the mills

And, as automotive manufacturers know, it takes a similar combination to break up the log-jams which have continuously threatened the industry's war program Only here, the log jams are production bottlenecks and the dynamite is industry wide cooperation, but the results are the same—war materiel has been released to flow from production lines to battlefronts in unprecedented quantities

When Jap bombs rained on Pearl Harbor a deluge of war orders cascaded upon the automotive industry Orders doubled and then tripled within a few weeks, creating a log-jam of work on new types of products, many of which hed never before been mass produced Successively, the industry faced such bottlenecks as machine tools raw material and manpower shortages

Just twenty-four days after the nation's dreams of peace were smashed, more than 500 automotive companies tossed their "know-how" into a grab-bag from which each could draw By pooling facts, interchanging production methods, seeking joint solutions to common problems, concerted action was taken by automotive leaders to blast the bottlenecks open

MACHINE TOOLS The most pressing problem of the conversion period was the lack of machine tools for fabricating war metals on the scale desired If the job was to be done, tools not assigned to war work hed to be located and placed where they would do the most good.

This task was given to the industry's newly created central clearing house—the Automotive Council for War Production Detailed information was obtained from printed cards sent to automotive and allied producers, on which they listed every unit of equipment on hand. In less than six months 240,000 pieces of productive equipment, scattered in 450 plants throughout the country, were indexed

As a result of the inventory it was found that about 28,000 pieces of automotive equipment were available Of this number nearly 10,000 machines, enough to completely equip ten tank arsenals, were switched from one plant to another, from Maine to Mississippi and from Altoona to Los Angeles

TOOLING UP Another tight bottleneck was caused by hundreds of companies tooling simultaneously making it essential to try to bring the work to the machine A Tooling Information Service was set up to give war producers who needed work done an opportunity to get together with tool shops which had open machine capacity for making tools, dies, jigs and fixtures

Gathering information from weekly reports submitted by approximately 400 tool and die shops, this data was compiled on special forms and mailed each week to more than 1,400 tool buyers throughout the nation

Among the effective bottleneck blasters were the product committees—organized to foster time and material saving techniques. One-time competitors, making similar items, met regularly to pool their knowledge and swap ideas Latest developments in such fields as aircraft engines, airframes, guns, ammunition, tank and combat cars and military vehicles were passed along for the other fellow to utilize More recently a military vehicles replacement parts group was set up to assist the Army with this phase of its huge supply problem For the most part these working committees are made up of production men and technicians

EXCHANGE Typifying the value of these groups is the example of the inspection gage which cuts the time required to inspect certain artillery parts from three days to ten minutes. Developed at considerable expense by one company, it was made available to the rest of the industry during one of the meetings.

Just recently difficulty in manufacturing a complex part—a reinforcing hull-rib—threatened one company's tank production. Committee discussion revealed that the part was being made successfully by another firm and arrangements were made to enable the first company's engineers to study the details of the process

MATERIALS With many log-jams broken, the flow of production was quickly assuming flood proportions, but in mid-1942 it was threatened by shortages and maldistribution of materials. A committee of the industry's top materials men assisted government officials in establishing realistic end-product schedules within the limits of available raw materials, thus alleviating to a degree a perplexing problem The committee also urged the various procurement agencies to adopt practical timetable principles of mass production, which allows schedules and allotments to be issued long enough in advance to achieve highest output of war materials

MANPOWER By 1943 manpower had become the principal bottleneck. Harking back to their earlier successful experiences in the tooling and production fields, the industry tackled the threatened jam by exchange of information and experience between companies

Special studies were made on worker training, morale, utilization, etc, and distributed throughout the industry, to other industries and to government agencies

Although many aspects of this problem still prevail the steps already taken presage solutions which should prevent manpower from actually jamming the flow of materials

Thus, the various segments of the automotive industry are welded together in a production team, aimed at outsmarting, outproducing and putting out of the running its one competitor—the Axis Its goal was clearly stated when industry made the pledge

"The nation will not lack for one gun, one tank, one engine, that the capacity and ingenuity of this industry's producers can add to the forces of our nation and its friend on all the fighting fronts"

Automotive "Know-how" Helps Armed Forces Speed Replacement Parts to Battle Zones

WHY HAS it become so difficult to replace worn-out parts on your motor car these days?

Because automotive spare parts, like thousands of other items obtainable at the corner store in peacetime, have gone to war in the shape of replacements to keep the Army's mechanized equipment in battle trim

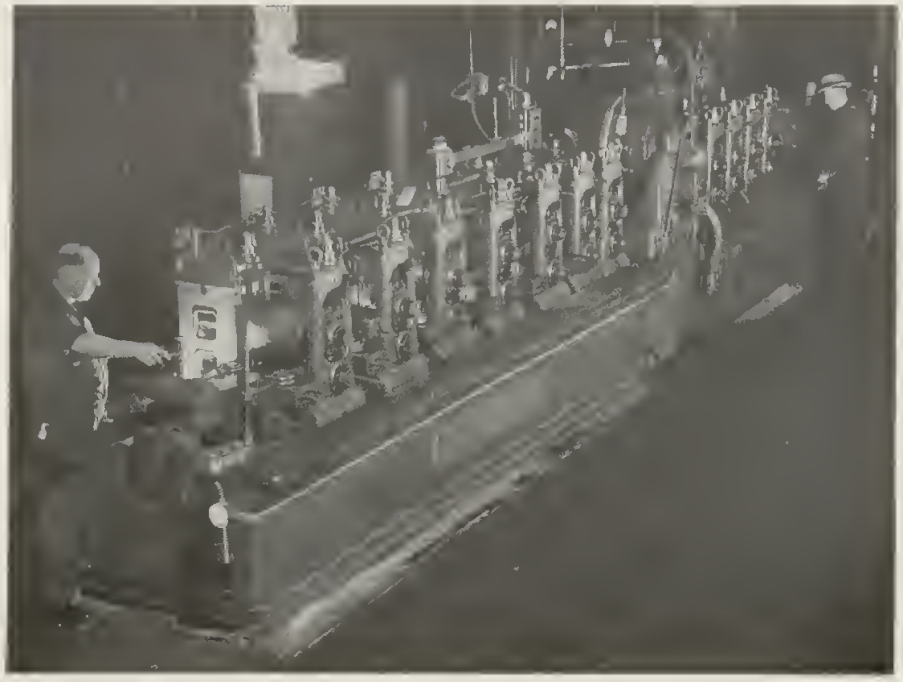
Since Pearl Harbor 1,500,000 tons of spare parts heve been produced by industry for Army Ordnance, it is estimated Moving all this material to a port of embarkation at one time would require a train of 1,000 locomotives and 75,000 freight cars. Such a train would heve its first engine in New York City and its caboose in Dayton, Ohio, about 710 miles away

When American troops first invaded enemy territory, the problem of delivering spare parts to battle zones proved a critical one. Then, in order to ship as much completely assembled fighting equipment as possible it was necessary to leave parts behind To offset this lack of spares, maintenance crews by necessity resorted to "cannibalization," a process where one good piece of equipment was torn down and its parts used to repair four or five disabled units

As shipping facilities increased, methods of packaging had to be improved so parts would be able to withstand a wide variety of conditions—extreme heat, cold, torrential tropic rains, or salt water corrosion So, automotive engineers began experimenting with new types of shipping crates, protective solutions to guard against moisture, and scientifically treated wrapping materials Today, nothing less than actual destruction of the ships stops the parts from reaching their destination in usable form

About a year ago the Ordnance Department called on the experience and skill of an automotive manufacturer to help streamline its system of storing and issuing spare parts An example of the improvements made by adopting automotive methods to the job is the saving of 49.2 per cent in storage area, including elimination of three large warehouses, effected at one Ordnance depot

More recently the Automotive Council for War Production completed a survey for Ordnance to eliminate duplicate identification numbers on tank parts From this indexing the Army plans to standardize its own system of numbering so that interchangeable parts may be more easily stored and made available to combat forces



Specially-designed machine maids strap steel into tubular shapes.

Industry's Peacetime Research Pays Off On Urgent Material and Production Needs

A PROCESS which squeezes paint almost "literally" from the air. A method which increased the manufacture of heavy gun barrels from 300 to 6,000 a month. The adaptation of automotive welding techniques to the production of aircraft parts.

These are just a few examples of the successful application of peacetime research to war production problems. The ceaseless search for ways to make better products, turn them out cheaper, make them last longer, produce them faster, has been a contributing factor in boosting the automotive industry's war production to its present $1,000,000 an hour rate.

Some of the developments have come from the superb research laboratories where chemical engineers, physicists, metallurgists probe into the unknown. Others result from the blending of science with the daily grind of production—the shaving of a few pennies of cost here, the elimination of a few minutes machining time there.

While research has developed beyond merely putting a mechanic with a monkeywrench on a tough job, all the developments do not come from the men in white, or from the test tube probers. Practical men with the keen sense of observation, with ability to adapt and apply, to revise and improvise, have demonstrated their capacity in a period when materials were scarce, manpower short, production needs urgent.

Illustrative of this, one automotive company recently described a paint-recovery process—the outgrowth of a research engineer's curiosity and a $12 cider press. It salvages basic materials from the paint-laden mists formerly exhausted from factory stacks.

First step in development was to equip each paint spray booth with a continuous water curtain across the back. This collected excess paint spray and carried it harmlessly off. Next, a small quantity of accumulated overspray was placed in the cider press and the water "squeezed" out. Thinner was added and the final product was sent to the paint supplier's laboratory. It was as good as the original.

So efficient is the recovery that as much as six and one-half gallons of new paint are produced from ten gallons of waste paint collected. It is estimated the amount saved since Pearl Harbor would provide one coat of paint for more than 185,000 typical 5-room houses, or enough to paint all the dwellings in New Hampshire and Vermont.

Another company reported that by eliminating forging and substituting seamless tubing, production of heavy gun barrels—used for 40 and 75 millimeter cannons—increased 20 times. This seamless tube application is the outgrowth of processes developed during the last 18 years.

Later, when the supply of seamless tubing became scarce, the result of widespread adaptation to gun barrel and other war projects, another firm substituted welded steel tubing—an old automotive technique—in the production of intake pipes for aircraft engines. This process was formerly used to produce automobile drive shafts.

Safety Records Set In Automotive Plants

DESPITE the addition of thousands of new workers to payrolls, industrial accidents in automotive plants during the war have been held to a minimum, and in many cases have shown a decline—testimony to the care that is exercised by the industry in eliminating working hazards.

One company, for example, recently reported that less time was lost by industrial accidents in the past year than at any time in its history. Only half a day per 1000 hours worked was lost during 1943, a record 16 per cent under the company's best previous mark.

Another company with 30 years experience in safety work attributes its high wartime record to a policy of maintaining direct contact between trained safety inspectors and employes.

Carefully selected, safety inspectors constantly are on the move in the plants, talking to foremen and employes, studying machines and operators' habits.

Every piece of equipment in the company's plants has been approved by safety engineers and receives periodic checks to guard against possible hazard. Included are 42,000 production machines, 22 railroad locomotives and yard cranes, and in one plant alone over 400 trucks.

All women employes in the plants are governed by special rules which supplement the regular safety rules of the company. Included are regulations specifying type of clothing as well as protective head coverings.

Trucks Equipped to Thwart Gas Attacks

Serve Many Needs of U. S. Fighting Men

AN automotive product devised to aid the farmer in his lifelong war against crop pests furnished the working idea for a military vehicle to spray neutralizing chemicals on roads and airfields which might become contaminated in the event of an enemy gas attack. This development once again demonstrates the extreme working flexibility and adaptability of automotive powered equipment in war and peace.

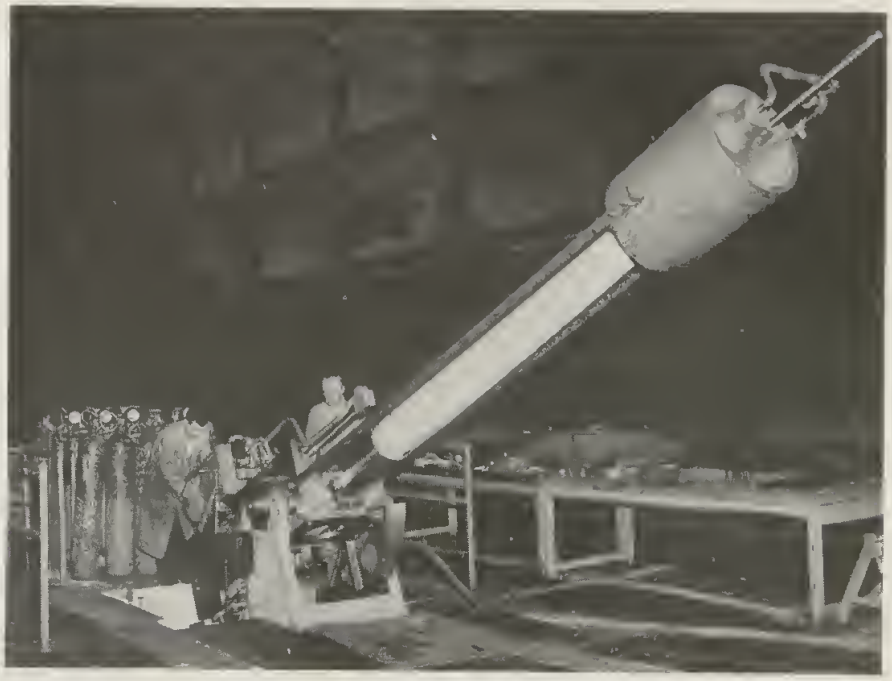
The vehicle, consisting of a 400-gallon wooden tank and pumping apparatus, is a six-wheeled 2½-ton truck that can go anywhere at a high rate of speed. The decontamination unit bears a strong family resemblance to an orchard sprayer and is featured by two spray nozzles capable of delivering 35 gallon of water a minute at 400 pounds pressure.

As in peacetime years when each type of truck manufactured was capable of performing a variety of jobs, the Army's decontaminating vehicle has taken on several additional tasks. At airfields it is used as an auxiliary fire and crash truck; it also has been used to lay dust on dirt roads; as a spray unit for camouflage work and pumping out cellars and dugouts.

In Africa, hundreds of foul stables and roach-infested warehouses were made spick-and-span quarters for American troops after a triple washing with diluted bleach from the unit. At Waikiki, Honolulu, it has proved useful in spraying insecticide on mosquito breeding places to combat dengue fever.

And with typical resourcefulness, American soldiers have found still other uses for the machine. In desert areas it is ideal for lugging cool water hundreds of miles to thirsty outposts. As a portable showerbath it is sprinkling dusty soldiers, to whom a bath is like a gift from home.

Chemical Warfare experts, who played a prominent role in the unit's development, state that not only is the decontaminating vehicle performing justifiable duties as a morale booster, but that these duties are also providing chemical combat units with valuable operating experience.



Five-inch Naval cannons "fired" inside factory walls

Unique Device Substitutes Compressed Air For Ammunition in Naval Cannon Testing

AND NOW compressed air has been put to work to defeat the Axis! True, it hasn't been taken right out on the battlefields or sea lanes as a new secret weapon. But it has been applied to the testing of five-inch Naval guns, those potent weapons which guard merchant convoys and arm destroyers.

When a contract calling for construction of a large number of these guns was awarded to an automotive concern, the company's engineers realized that a great deal of time and money would be saved if it were possible to test the weapons without having to build an outdoor firing range.

From their experiments evolved a device which tests by simulating actual firing conditions the kick, rammer and firing qualities of the big five-inch guns. With the use of compressed air the apparatus obtains the same results as would be recorded by actually discharging the weapon.

The company also reports that peak production on the contract, placed by the Navy in September, was reached shortly after the first of the year. Already hundreds of the guns manufactured by the firm have been accepted without ever firing a shot.

In order to increase production of the powerful guns, the major manufacturing operations have been divided among four automotive plants, while a fifth handles machining operations and final assembly.

Production of the Naval cannons was preceded earlier in the war by manufacture of anti-aircraft guns. Facilities to take on the new job became available when orders for the latter items were cut-back, a further indication of the flexibility that must be maintained on the home front to meet the shifting needs of the battlefronts.

AUTOMOTIVE WAR PRODUCTION

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Automotive Mass Production Techniques Boost Bofors Gun Production 30 Times

FOREIGN-BORN, she reflected many Old World characteristics. Her outer garments were done in the traditional manner, with many skilled hands helping make them. A peaceful valley in the heart of central Sweden was her original home, but because of her peculiar talents she was brought to America.

No lady, her business is death—and she is feared throughout the world. Most American servicemen know her as the Bofors 40 mm. anti-aircraft cannon—a mighty handy weapon to have around when a Jap or Nazi dive bomber is coming in for the kill.

A few weeks ago the Navy told quite a tale about the Bofors and the new battleship South Dakota. On that vessel's very first run in the South Pacific, the ship was attacked by 32 Jap Torpedo bombers. In 30 minutes shells from the Bofors had blasted every enemy plane from the sky.

That's the kind of a job the Bofors is capable of doing. That's why the gun is acclaimed by military experts as the best of its type. But before it could be built in this country it had to be adapted to mass production techniques. The transformation wasn't easy. Remember, the Bofors came from a land where precision work is done by hand; where it takes 20 years to train a constructor, or master artisan, and at least four years to qualify the ordinary workman for his trade.

So the gun was brought to an automotive company. Here it was examined and its manufacture simplified by breaking it down into 1,500 component parts. Measurements and drawings were changed from meters to inches; metal requirements were reduced to SAE specifications; and two experimental guns were built by hand to assure the accuracy of the new standards.

Then came the task of locating tools, manpower, materials, and the charting of production flow. The hard-to-make subassemblies and parts such as gun barrels and water jackets were tackled by the company, while subcontractors were located to supply nearly 50 per cent of the other parts.

In planning the manufacture of the gun the company borrowed freely from its automotive production experience. Techniques to assure longer life for the weapon and to make it easier to repair were utilized. Time, money and materials were saved when hand-fitting operations was changed to automatic machine work.

The recoil spring retainer collar, originally machined from bar stock, was replaced by a brass casting. Instead of being machined, the gun-sight plate was cast from powdered metal, saving 95 per cent of the labor. The gun's flash hider, formerly machined from a solid steel forging, wasted 90 per cent of the material. A plain steel tube, molded by special dies into a bell-shape, now does the job with a minimum of scrapping. An automotive technique cut the time for drilling the gun barrel by 50 per cent. With a new broaching cutter, rifle grooving time was reduced from six hours to 45 minutes.

Less than five months after the company had started to change the drawings, the first two hand-built guns were tested and approved by the armed services. Eight months later the company was producing the deadly Bofors in volume.

Today, thousands of these weapons from Sweden are speaking for America. They arm our ships and fortify our bases. They are in action wherever American soldiers and sailors fight. Automotive mass production methods have made it possible for the Bofors gun to be produced 30 times faster than it ever was before.

DID YOU KNOW?

Two automotive companies have each announced production of their 10,000th medium tank, while a third concern has revealed output of 100,000 military trucks. This is seven times the number of trucks used in the Sicilian Invasion and nearly 34 times the number of tanks employed.

* * *

There are 3½ million square feet of floor space in the 14 buildings of Rockefeller Center. The floor area in at least four aircraft plants of the automotive industry equals or exceeds this total.

* * *

Because of the widespread use of aluminum and magnesium in aircraft work, one automotive company has been able to share approximately 72 per cent of its steel output with other war producers. Before the war, the company's total output supplied only 75 per cent of its own steel requirements.

* * *

Of the 1,670,000,000 horsepower installed in America, 1,424,000,000 or 85 per cent of the nationwide total is under the hoods of passenger automobiles and commercial trucks.

AUTOMOTIVE
WAR PRODUCTION

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Automotive Production Keyed to Special Plant Types

Rearranging automotive plants requires time and effort.

Motor Factories Designed to Permit Free Flow of Materials Through All Stages of Assembly

THE MODERN automotive factory building, while little more than a shell that encloses acres of manufacturing equipment, is nevertheless a key factor in the current $1,000,000 an hour war output achieved by the industry.

Likewise, it's a cornerstone in any program for reconversion of the automotive industry that may be mapped in the distant months, or years, ahead.

Currently, discussion of automotive plants creeps into many an official conference in Washington. There is talk of getting materials out of the *plants,* removing tools from the *plants,* getting the *plants* back after the war.

Why do these structures of steel, mortar and glass figure so prominently in reconversion conversation?

The reason is that mass production's first need is factories—factories designed like the special purpose tools of mass production, for specific and unique tasks.

Motor plants are strictly utilitarian and practical in construction, laid out so that raw materials can move logically and freely from unloading dock to fabricating machines and to final assembly line, in a continuous flow. Material handling is kept to a minimum

Some types of industrial production can be conducted in almost any adequate factory building containing the usual number of walls, utility lines, roofs and floors. But the production of hundreds of thousands of metal parts, and the assembly of them into units the size of automobiles and trucks, requires industrial structures expressly designed for that purpose. Low cost production is the objective.

Experience gained during more than thirty years of architectural research and engineering study taught automotive producers that their plants must cover all of the operating area on one floor if possible, and that it should all

(Continued on page 3)

INDUSTRY ANNOUNCES WARTIME PRICE CUTS

Costs Tumble on War "Models" as Automotive Industry Applies Efficiencies of Mass Production to Current Jobs

COINCIDING WITH SPRING showings here and abroad, the automotive industry this week announced a new range of prices on its 1944 "War Style" models.

In the face of rising costs in many commodities, the automotive industry revealed substantial price reductions throughout its current line of war products.

Automotive-made Liberator bombers now sell for $137,000 as compared with $238,000 two years ago; light tanks have been reduced to $22,564 from $45,000; machine guns (50 calibre) are priced at $200 today as against $510 last year.

The industry's only customer today, the Government, is able to buy 28 sets of precision aircraft engine parts for the same price paid for 10 sets last year. Wings for Flying Fortresses sell at monthly savings of $235,927.80. Price reductions on engines for swift fighter planes have amounted to 34 per cent since 1940.

Such savings result from the ingrained practice of automotive manufacturers, members of the world's most competitive peacetime industry, to constantly improve products and production methods. The wartime continuation of these practices has resulted in better and less costly fighting equipment.

Take, for example, the 43 per cent reduction in the cost of Liberator bombers. Considerable credit for this is given to application of automotive tooling methods to aircraft manufacture. Installation of the special jigs and fixtures which hold tools and airframes in position while manufacturing operations are being performed greatly simplifies work and allows for sharp step ups in production. More than 3,000 Liberator bombers have rolled from the assembly line of an automotive company that is so tooled up.

The 1944 price tags on B-24 bombers will represent an aggregate saving to the government of more than $450,000,000 from the price of two years ago, a high army spokesman recently stated in announcing a contract renewal for 4,500 more bombers. Had the contract been placed at prices prevailing one year ago, the total cost would have been $171,000,000 more than today. And included in the present price are improvements valued at several thousand dollars per airplane.

On the production of Flying Fortress wings, time requirements were impressively cut through the installation of 16 automotive-type conveyor lines with an attendant saving of 185,660 man-hours per month. This is equivalent to a dollar saving of $235,927.80 monthly, although conveyorization cost has not been computed.

The old automotive industry maxim that "as production goes up, unit costs tumble" is again borne out in the case of the company producing .50 calibre machine guns. The 61 per cent price cut on this item during the past year followed long months of work by engineers who changed the design, manufacturing methods or materials on approximately 145 of 270 parts. This simplified manufacturing procedures, eliminated waste and made possible low-cost, high-volume mass production methods.

Attainment of volume production on light tanks and precision aircraft engine parts enabled another company to effect considerable savings in both lines. Tank prices were reduced by approximately 50 per cent, while nearly three times as many aircraft engine parts are being delivered today for the price prevailing a year ago.

Plant Facilities Key to Mass Production

(Continued from page 1)

be under one roof, not in scattered separate structures. Inside working area measured in acres was needed, and industrial architects began thinking in terms of great size on a single floor level.

The assembly lines should be straight and uninterrupted, so the minimum number of pillars was allowed. This meant a new type of roof construction, and stronger walls. Big overhead cranes were in demand to service the assembly lines, so more strength must be introduced into both walls and framework. Model changes would call for machinery rearrangements, and therefore the flooring and foundation must be solid enough to absorb the shocks of this heavy machinery, wherever it might be placed to operate.

Extraordinary facilities for electrical energy, communication wires and conveyor lines must be available without interfering with the working area. And, since the industry delivered a finished consumers' product, the plant itself must be light and clean to insure accurate, polished work throughout the final assembly process.

Dozens of plants were built to these specifications, and at their peak 20,000 cars a day rolled off their assembly lines. In the hectic conversion period following Pearl Harbor, this careful pattern was destroyed. In the reshuffling, overhead conveyors were slashed from their moorings, big presses uprooted from their concrete bases, walls knocked out and ceilings raised. These plants were adapted to war production.

With the advent of the war program there developed a national need for specialized plant facilities to manufacture and assemble large, complicated war products. Heavy bombers, precision aircraft motors, and armored tanks fell in this category. New plants for this type of work were laid out in accordance with established principles of mass production that emphasized flow techniques. Government-owned, these plants are operated by industry.

"Does industry plan to purchase these plants after the war?" is a frequently asked question.

While no official views are on record from the automotive industry, a national business publication recently obtained informal answers to the question from a dozen motor companies.

Almost without exception, the companies felt that high construction costs of the government-owned plants, due to overtime rates and high material prices, were real barriers to the purchase of these facilities. Because of the seven-days-a-week work that went into them, many buildings had about 21% added to their labor costs. Other items of expense are the special floors, elaborate construction and other factors not required to make civilian goods.

A typical figure cited was that of $5.50 a square foot for Defense Plant Corporation plants, against a normal cost of $3.50 in 1937.

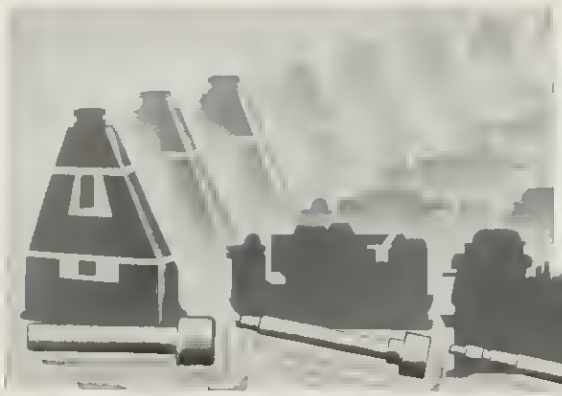
Since building costs are a part of overhead, which has to be held down to keep automobile prices low, automotive companies have manifested more concern with getting their own plants in shape at war's end, than in acquiring government facilities.

For their own plants were built for the specific purpose of making passenger cars and parts. Their availability, therefore, will be the key factor in reconversion. Any considerable delay in getting the plants cleared will delay the employment of hundreds of thousands of workmen.

As it is 100% converted to war production, and someday must convert back, the industry has taken the leadership in emphasizing to Congress and government agencies the need for legislation to make possible the speedy removal of obstacles to civilian production with the coming of Victory.

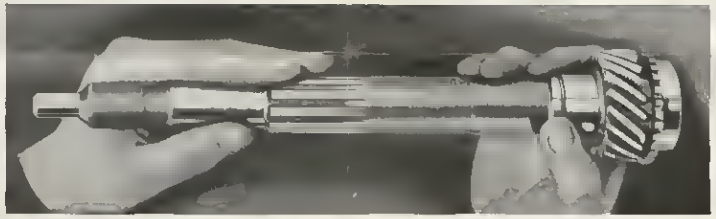
The necessity for getting preliminary work out of the way before the awaited period arrives is as evident as it was to the hunter who advised expectant diners, assembled hours early for supper, "to make a tasty rabbit stew you must first catch your rabbit."

Specialized plant facilities have been required for big war jobs.



PRODUCTS AREN'T MADE ON ASSEMBLY LINES

The real effort takes place on production machines, arranged in sequence for quick, precise manufacture



"NEITHER CARS nor war materials are built on assembly lines They are built on production lines They are only *put together* on assembly lines"

A walk down the final assembly line in peacetime, where a car-a-minute is the accustomed pace, gives the plant visitor only a fragmentary picture of the effort that goes into automotive production The same effect is true of war production

The main effort as an industry speaker quoted above indicates, is in the thousands of man-hours of work behind the assembly line—the work that precedes the dramatic step of cars, trucks or war products going together before the visitor's eyes

In the final assembly stage, workmen reach overhead to a trolley conveyor for parts that are always there when they need them. A triumph of planning? Yes But the $64 question is *Where do the parts come from?*

They come from production lines. Production lines are not made up of conveyors, but of machines. It may take as many as 100 machines to produce a single part. Take, for example, the comparatively simple part shown above It is a pinion from a motor truck transmission It requires a line of 39 machines to make it It may look simple but here are some of the operations and machines involved

It starts as a plain bar of iron. A big steam hammer stamps it into a die so that an orange-like ball bulges where the gears show when finished

It is placed in a fixture on a machine Here it is cut to exact length. It then is fed to another machine that finds the exact center of the cut ends and drills a small, cone-shaped hollow in each end. Then it goes from lathe to lathe to lathe, each of which roughcuts or finishes a certain diameter or bevel or groove Then the gears must be cut—three machines for each gear —and it must be slotted and nursed to the finished product From start to finish, thirty-nine machines are used, each in its proper sequence This is a typical "production line"—in no way resembling an assembly line.

The machines, however, are only a small part of the story To produce this part also requires 194 tools, dies, jigs and fixtures, all specially built for that part These might be compared to the vise and brace-and-bit you use to bore a hole in a board The vise is the fixture, the brace, the arbor, the bit, the tool, and the clutch that holds the bit is called a jig These things however, cannot be standardized as they can on your workbench

Then, in addition, there are 153 gages required to insure accuracy at every step

This is a typical "production line" It requires several hundred of them, consisting of many thousands of machines, to feed the parts to the assembly line that is familiar to you All of these things are necessary to build one motor truck Similar steps are needed to build a passenger car

Over a period of many years, automotive manufacturers had pretty much standardized their plant layout and the positions of these lines Now, however, all has changed Every car "production line" has been torn out by the roots. Machines have been shuffled like a deck of cards, many even being sent to other plants Machines have been rebuilt too, for war work It took more than 1,000 skilled man-hours to rebuild some of them.

No, the problem of getting into car production again isn't a matter of just getting the assembly lines set up Some manufacturers might do that in a month But the production lines, hundreds of them involving thousands of machines, are a different matter. This work cannot even start until the automobile plants have been cleared of the entirely different machines and machinery used for the making of modern war materials.

This is one of the reasons why considerable advance planning on the part of both industry and the government is needed before peacetime employment in automotive plants can be provided

Physical Problems Created by War

For two years the automotive industry has been 100% converted to war. Its job of getting back into civilian production, therefore, will be more difficult than for most industries when peace comes. Two large peacetime manufacturers of passenger cars recently gave these facts about their respective companies' reconversion task*

ONE COMPANY'S POSITION

Out of 75,000 automobile machine tools that this company owned, 50,000 were converted to war production.

More than 3,000 automotive machine tools were disposed of to other war producers

60,000 government-owned machine tools are mixed together with this company's automobile equipment These are scattered, not only in the company's peacetime plants, but in the 12,000,000 square feet of war plants erected by the government.

To reconvert, $500,000,000 will be spent for retooling, modernization and plant expansion

Specially designed government-owned machine tools must be cleared from company plants

Essential machines, many of which were sold to other war producers, must be replaced or recovered

$500,000,000 worth of wartime inventories—parts in process and raw materials—must be removed from company plants

At least 45,000 new machine tools are required.

ANOTHER FIRM'S PROBLEM

This particular automobile company converted 87% of its automotive machine tools to war production, i.e., rebuilt them, modified them, adapted them

There are 7,039 government-owned machine tools in the company's own plants

There are 20,903 government-owned machine tools in all the plants the company now operates, of which 2,000 machines might be usable in peacetime work.

To store these government-owned tools, 3,000,000 square feet of floor space would be required.

It would cost the company $2¼ million to get these government-owned tools out of the way

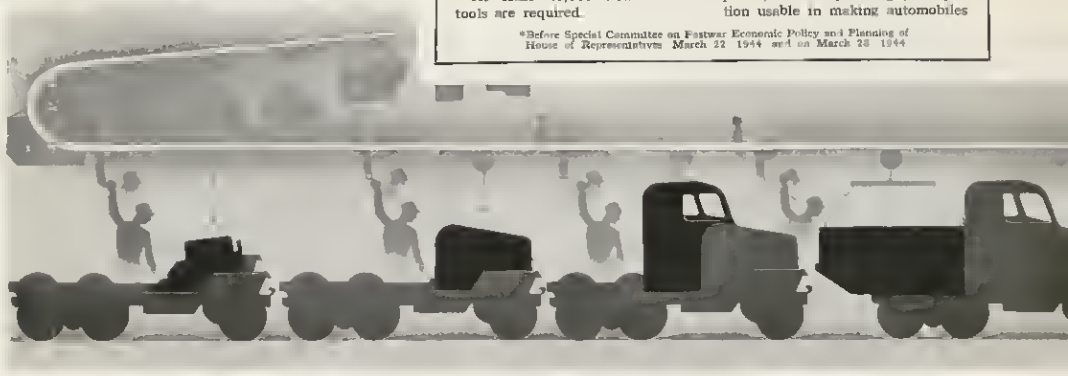
There are $150 million of raw materials and processed materials in the company's plants.

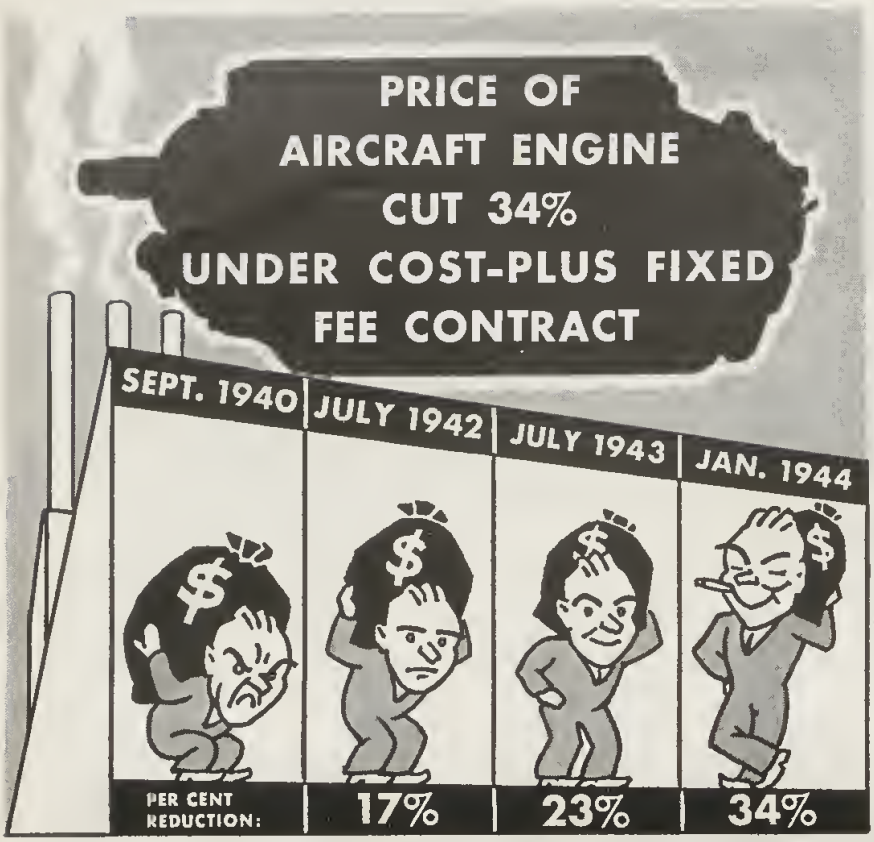
The company has contracted for, and therefore has a purchase commitment liability for, $500 million of supplies and raw materials.

(The company's entire net worth is $177 million.)

There are 75,000 tons of raw materials in the company's own plants, with only a negligible portion usable in making automobiles

*Before Special Committee on Postwar Economic Policy and Planning of House of Representatives March 22 1944 and on March 28 1944





Fixed-Fee Type Contracts Demonstrate Worth When Costs Are Unknown on New War Products

"IT'S TOO complicated and intricate to ever be built in volume." That was a typical comment heard back in 1940 when the Treasury Department called manufacturers to Washington to view a British liquid-cooled aircraft engine.

Today, that same engine is rolling from assembly lines of an American automotive company in mass quantities, as it has been for the past two years. Though many months elapsed while planning, engineering and tooling went forward, the annual output of that engine is now well into five figures, and it's still climbing. Production during the past year was 70 per cent higher than the preceding 12-months period.

While production on the one hand has marched upward, costs on the other have declined steadily. In July, 1942, the original contract-estimated cost on which the fixed fee is based was cut 17 per cent per engine. A year later further manufacturing efficiencies resulted in another 7 per cent reduction in estimated cost. Today's engines are rolling from assembly lines at a saving to the government of 34 per cent under contract estimates of three years ago.

After the first engine reached quantity production, the company contributed to the development of a second engine, which is capable of carrying bombers and fighters at greater speeds and higher altitudes.

Though far more difficult to manufacture, the new engine was introduced at greatly reduced prices. It, too, has since progressed through a series of refinements and today is being built 20 per cent below the original estimated cost. In 1943, alone, by efficient operation the company was able to effect total savings of $64,000,000.

Recent contract revisions provide a fixed fee per unit 50 per cent smaller than the original amount due to lowered costs, close scrutiny of contract performance, and government policy of periodically reducing the percentage of fee allowed under cost-plus-fixed-fee contracts.

The above case history is typical of how cost-plus-fixed-fee contracts in the industry work to the benefit of the nation both from the standpoint of greater production and cheaper costs.

Entered into chiefly on products so "complicated and intricate" that it is impossible to accurately forecast what costs will be, such contractual arrangement accounts for only 27 per cent of the total current war deliveries by the automotive industry.

Differing from the cost-plus contracts of the last war, in which fees often soared as costs increased, today's contracts call for payment of fees which are fixed per unit. As various cost items are ruled out by government auditors, the fixed fee is automatically whittled down.

In the automotive industry, many cost-plus-fixed-fee contracts have been converted to fixed-price contracts, when enough information was available to warrant setting a unit price. Facts on cost are essential in figuring a fair price to the government and in protecting the manufacturer against the possibility of error in unit cost determination that might quickly force him into bankruptcy.

On many types of war assignments, particularly in the aircraft field, modifications in the product are very frequent and unpredictable, making it virtually impossible to set a unit price. In the above aircraft engine, for example, more than 6,900 designs and engineering changes have been made since production started, and they will continue for the duration. Though they deter production and are costly, such modifications are dictated by battle-front experience.

While both government and industry prefer the fixed price contract for standardized production, records in the automotive industry reveal that the cost-plus-fixed-fee arrangement generally is proving satisfactory. Under Secretary of War Robert P. Patterson, in testifying before the Senate Military Affairs Committee, stated that "cost-plus-fixed-fee contracts frequently compare favorably with operations on a fixed-price basis."

Propellers are being produced by two automotive companies, he said, with costs to the government under the fixed-fee contract substantially lower than those of the fixed price contract. Likewise the record of an automotive company producing an air-cooled aircraft engine under the former type compares favorably with that of two other firms producing engines under fixed price contracts, the Under Secretary of War revealed.

Ports must be constantly available to keep equipment battleworthy.

Industry Streamlines Spare Parts Operations To Meet the Demands of "Triphibian" Warfare

IF YOU CAN imagine a sailor in Central Park stuck with a rowboat and no oars, then you can appreciate a soldier at the front without spare parts for his fighting equipment.

For the value of replacement parts is emphasized when planes are unable to get into the air or military trucks flounder in the mud—all because of the lack of some essential unit.

The speed with which weapons are overhauled, repaired and returned to battle frequently spells the difference between victory and defeat.

Providing spare parts in the quantities needed to satisfy the demands of "triphibian" warfare—i.e. land, sea and air fighting—occupies a large share of the automotive industry's war production efforts. For every piece of war equipment delivered to the services a pre-established number of replacement parts—calculated on what it takes to maintain 100 units in the field for one year—go from automotive plants to army storage depots.

For example, companies that manufacture the big 4 x 4 trucks supply 1,200 items for replacement purposes. It is estimated that 17,000 separate parts are delivered for new superbombers. One aircraft engine manufacturer reports that 40 per cent of total production goes for spares.

A sage once wrote: "For lack of a nail the shoe was lost." Today's parallel might be: For lack of wing tips bombers were grounded; for lack of oil fuel lines trucks were stalled; for lack of spare parts a battle was lost.

To prevent this parallel from becoming reality and to expedite the flow of parts to Army depots in this country and overseas, automotive companies are constantly streamlining their spare parts divisions. One company recently completed work on a building containing half a million square feet of floor space.

Ordinarily, spare parts are shipped by automobile companies to local Army storage depots, where they are redistributed as orders come in from camps in this country and battlefronts overseas. On occasion, however, emergency orders are shipped in Army transport planes direct to combat areas.

Not long ago the bomber factory of one automotive company received a rush order from a Mediterranean base for flexo shafts, vital unit in the operation of an airplane's automatic pilot. Preparations were being made for a large-scale raid on a German-held Italian city, and it was essential to get as many planes as possible into the air. Three days after the carefully boxed parts had been loaded into an Army airplane at a field adjacent to the factory, the units had been installed on the grounded bombers.

In another instance six bomb-bay door sets were rushed overseas for installation on the ships which took part in the tree-top raid on the Ploesti oil fields deep in Rumania. Although it is possible for a plane to fight without bomb-bay doors, the protection value to crews of such equipment was shown when the bombers were examined after the attack.

Fire from burning oil dumps had seared all the paint off the bottom sides while tree tops and branches were stuck in many bomb-bay doors.

DID YOU KNOW?

A total of 350,000 miles, equal to a trip to the moon and half way back again, has been rolled up in driving tests at the military vehicles proving ground of one automotive company during the past seven months. Trucks ranging from quarter-ton to ten tons, Jeeps, halftracks, command cars and tank recovery units are among the types regularly put through their paces at the outdoor laboratory.

* * *

One automotive company paid its employes nearly a million dollars in War Bonds and Stamps during 1943 for more than 25,000 acceptable production suggestions to save time and materials, cut costs and improve safety. Awards were made for one out of every five suggestions turned in, with the maximum of a $1,000 Bond being presented to 111 employes.

* * *

Designated the M-8, a new six-wheeled, seven-ton scout car with the ability to ascend a 45 per cent grade and travel at high speed over almost any type of terrain has been announced by an automotive company. Features include a low silhouette, full armor plate, special puncture-resisting combat tires, and armament consisting of a 37 mm. anti-tank gun and a .30 calibre machine gun.

* * *

Utilizing automotive type assembly line methods, one company located more than 700 miles from the seacoast is fabricating an average of 13 small ships a day. The vessels are used principally for the transfer of military personnel and equipment between transport ships and shore, and for special jobs on coastal and inland waterways.

Produce from Victory gardens will help nation meet 1944 farm goals.

War Workers Aided with Victory Gardening As Motor Plants Get Behind Crop Drive

PNEUMATIC DRILLS, blasting away at a concrete driveway, heralded Spring's arrival at one automotive plant recently.

The rich earth beneath the cement was needed for a model Victory garden, one of the many the motor company has installed on its premises as a visual aid to its employes' gardening efforts. With no other convenient spot available, the concrete came out and the seeds went in.

Automotive management is going sled-length in many an industrial community these days to make it possible for the factory war worker to grow his own produce again this year.

Demonstrating "how it's done" is one means of giving impetus to the Victory garden movement. Another is to offer prizes for the best home garden, the tallest corn, the greatest yield. Distributing booklets giving gardening hints is also a common practice in the motor plants.

To encourage the gardening movement, several automotive firms have acquired land—then had it plowed for their employes. A number of others have compiled the equivalent of "What Every Young Gardener Must Know" for the benefit of novices at the art.

As several automotive companies have a background of experience in community gardening, their current programs are a continuation of that effort. As long ago as 1920 one automotive firm's workers cultivated 900 gardens on company property. This year, however, the Victory gardening program is being greatly intensified throughout the motor industry.

For the War Food Administration has called for a 10 per cent increase over last year's record of 20,000,000 Victory gardens, which accounted for one-eleventh of the nation's food supply and 42 per cent of the fresh vegetables consumed. New quotas include a 43 per cent increase in canned foods and a 19 per cent increase in canned vegetables over the 1943 "home pack" of 4,100,000,000 cans and jars if this year's food goals are to be met.

In addition to helping the nation meet production and farm goals, this wartime "back to the soil movement" enables automotive workers to cut family food bills, stretch ration points, and build up health through outdoor exercise and relaxation.

Broadening its garden activities this year, one automotive company is providing employes with 250 plots, 20 by 30 feet in size. Covering six acres, the plots have been plowed and dragged by the firm.

Nearly 40 model gardens adjoining plant entrances are planned by another automotive company. To aid "embryo farmers," experienced gardeners will be in daily attendance thoughout the season to demonstrate latest methods of battling bugs and beetles, weeds and weather. As a further help, a pamphlet—"The ABC of Victory Gardening"—is being distributed.

Nearly 300,000 special booklets, outlining the do's and don'ts of Victory Gardening, have already been distributed to employes by another automotive company. The booklet emphasizes fundamental rules for a successful garden; contains a guide for crop planting; a diagram of the ideal garden; a planting calendar showing latest frost dates in all states; and a "Rogues Gallery" of garden pests with correct methods for eliminating them.

AUTOMOTIVE WAR PRODUCTION

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Automotive Council for War Production

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New Center Building, Detroit, Michigan

AUTOMOTIVE

WAR PRODUCTION

FOR VICTORY BUY UNITED STATES WAR SAVINGS BONDS STAMPS

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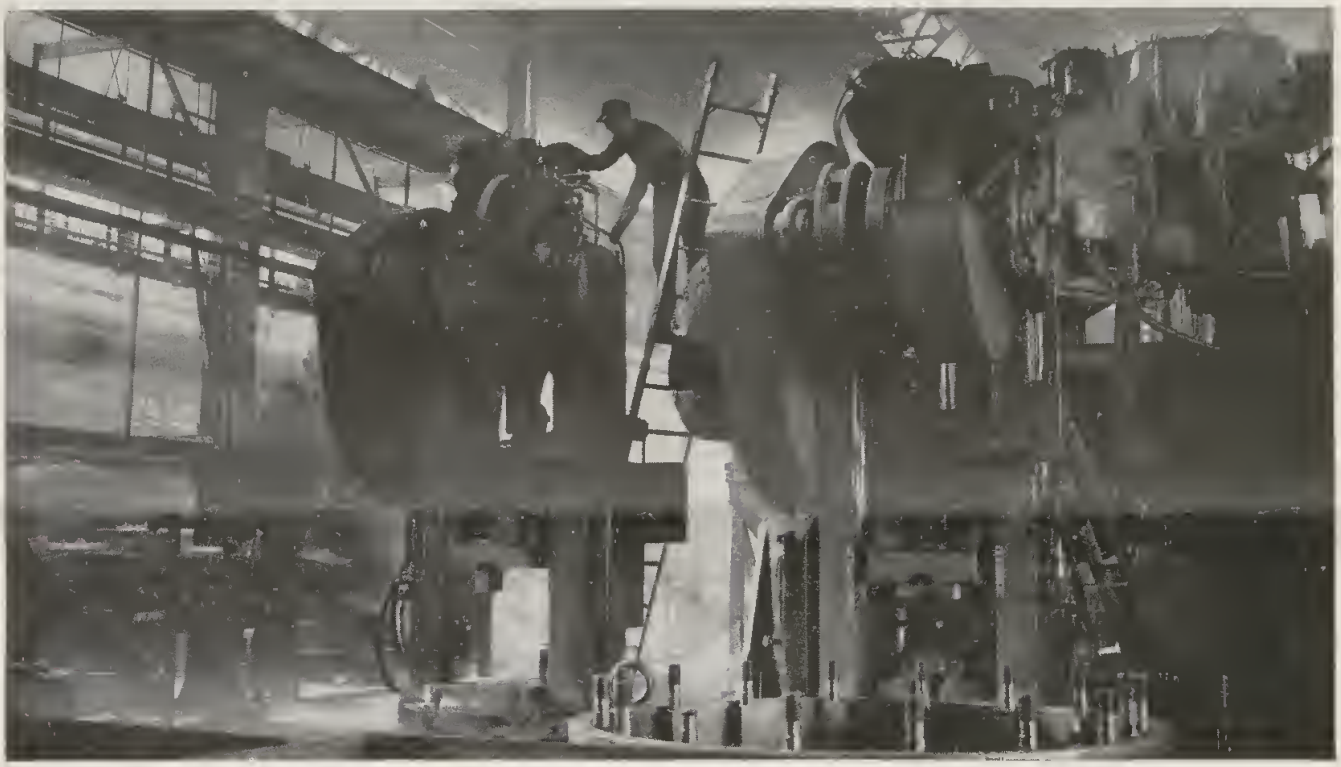


Plans for Removing Machine Tools Would Aid Plants

Re-arrangement of Facilities Will Be Delayed Until Disposal of U. S. Equipment Is Decided

IF YOU can imagine moving 100 acres of equipment, some of it as huge as the battery of presses above, you can visualize the job one automotive company will face in the future when it sets about to reconvert to civilian production.

Or if you can picture two and three-quarter million square feet of government-owned machinery (that's a floor area equivalent to about 25 Yankee stadiums) intermingled with industry-owned equipment, then you can appreciate another automotive firm's job of unscrambling its facilities after the war.

The task of revamping a plant set-up, so that civilian tools will occupy the space now needed for war production tools, belongs to automotive layout men, who huddle over long tables resembling giant chess boards and plan each step in production.

A home builder's care in getting his bedroom located on the sunny side of the house is no more exacting than that displayed by the layout man in getting a battery of turret lathes placed in the spot in the plant where they mesh best with other production facilities.

For it's a dollar-and-cents matter in peacetime and a life-and-death matter in wartime to get the best possible arrangement of productive equipment.

As one prominent engineer recently commented:

"Plant layout is an industrial fundamental. It determines the efficiency, and in some instances, the survival of an enterprise."

In peacetime, automotive engineers customarily rearranged their plants on paper at least six months before new models came out. More than $300,000,000 a year was spent by the motor industry to replace worn tools and build new facilities. So the art of re-arranging a motor plant's productive pattern, developed to a fine point, became an integral part of automotive manufacturing procedure.

(*Continued on page 6*)

Land-locked Automotive Plants Use Facilities To Produce Many Types of Sea-going Ships

SEA-GOING vessels, formerly fabricated in sprawling ocean-side shipyards are now being mass-produced inside factories more than 700 miles inland. Several automotive plants are turning out the ships on an assembly-line basis —much as automobiles and trucks used to be produced.

Among the more famous of these is the "Duck," a 2½-ton amphibious vehicle used effectively as either a personnel or cargo carrier; the amphibious "Alligator," an armored tank-type assault craft; a new type marine tractor and a tug, dubbed the "Sea Mule."

Many striking reports of the value and versatility of these automotive-produced weapons have come from the invasions of Jap-held Pacific islands, of Sicily and Italy. Take, for example, those about the Duck:

On New Britain Island, two Ducks spearheaded the successful assault on the Arawe Peninsula. At Sicily, the first hundred enemy soldiers to see the Duck immediately surrendered, thinking it was an amphibious tank. Near Naples, a 105 mm. howitzer was carried from ship to shore in a Duck under cover of darkness. Eleven minutes later the gun was dropping shells on the surprised Nazis.

Over 30 feet long and eight feet wide the Duck is in reality a standard six-wheel truck mounted in a boat-like body. A watertight steel hull encases the frame, with the springs and wheels emerging underneath. On land, the unit is driven through all six wheels, while in the water it is driven by a rear-mounted propeller.

The vehicle was developed by an automotive company, in cooperation with Ordnance engineers, when high Army officials sought to reduce "beach activity" to a minimum. With the ordinary type landing barge that stops at the shore line, troops often were forced to unload supplies out in the open, facing the onslaught of the enemy's air and ground defenses.

Just 38 days from the time the automotive company which pioneered the Duck received the original letter of intent from the War Department, the first of these amphibious vehicles had been built and was engaged in actual testing operations. Many thousands have been manufactured since and production continues upward each month.

Another example of the specialized equipment developed by automotive companies to meet the demands of amphibious warfare are the two "Sea Mules." They were designed to facilitate the transfer of personnel and equipment from ship to shore, and for service on coastal and inland waterways.

The Sea Mule tractor utilizes the principles of the outboard motor, serving as the power unit for otherwise immobile cargo-carriers such as barges, scows and lighters. Actually it is an automotive produced marine engine enclosed in a steel pontoon—complete with propeller, rudder and controls—which is attached to the stern of the vessel to be propelled.

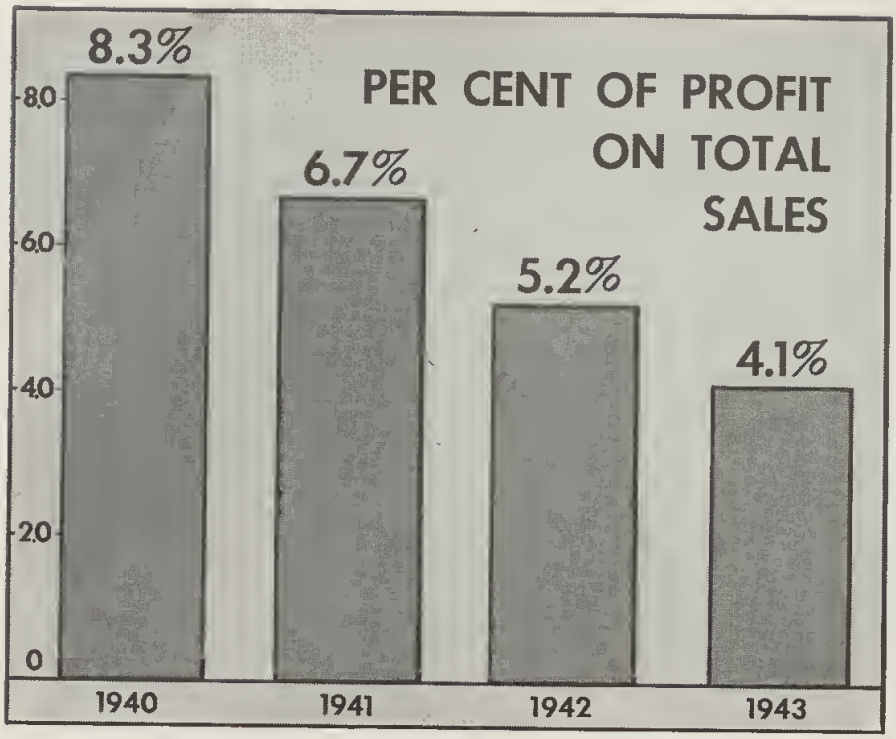
To supply the need for a self-contained vessel that could navigate any type coastal or inland waterway, two tractors and two other pontoons were combined to form the Sea Mule tug. Bolted together, these sections make a highly maneuverable craft capable of handling loads of 1,000 tons.

The comparatively small size of the Sea Mule over the conventional type of tug-boat affords a distinct advantage, since the four units comprising the tug are small enough to be shipped by rail or steamboat to the point of use. An ordinary railroad gondola car holds two sections of a Sea Mule tug, or two cars to the complete vessel. They are easily handled by a small traveling crane or a ship's cargo boom, and may be stored in the hold of a larger ship.

Many thousands of these novel vessels are now in service throughout the world. The British use them at home and on various fighting fronts. The United States Army ordered a special model for use on the Yukon River in Alaska, while the Rubber Reserve Corporation uses them on the Amazon River to bring out crude rubber. They are in service in India, Australia, the Pacific islands and other remote places where ship-to-shore movements of men and materials are a problem because large boats are forced to unload at varying distances from harbor wharves.

In addition to its "shipbuilding" operations, the automotive industry has further contributed to the marine field by applying its knowledge of the internal combustion engine to the production of power units for all types of combat vessels.

As examples, 1,500-horsepower engines for PT boats are in volume production at one company. The four major types of landing craft used by the Navy are Diesel powered, with 71 per cent of the engines coming from another company. Gasoline units are supplied for patrol boats, landing craft, picket boats, fishing boats and bomber loading boats by still other companies.



Profit Margin in Automotive Industry Is Cut In Half Since 1940, Recent Reports Show

THE PROFIT margin of automotive companies on total sales has been cut in half in the past four years, a recent analysis of available 1943 annual reports shows.

Net income after taxes last year amounted to 4.1 cents per dollar of sales, compared with a profit showing of 8.3 cents in the peacetime year of 1940, a survey of 36 automotive vehicle and parts manufacturers discloses.

The margin of profit on sales in the automotive industry has been steadily dropping. the year by year comparisons being as follows:

Year	*Net Profit*
1940	8.3%
1941	6.7%
1942	5.2%
1943	4.1%

In 1943, total taxes paid by automotive concerns were more than twice as great as net earnings after federal taxes. Out of every $1 of sales, 8.5 cents were paid in taxes.

In 1940, for every $1 of net income the tax collector took $1.11, while in 1943, the tax ratio amounted to $2.07 for every dollar of net income, reflecting an increase of almost 100 per cent.

Despite the fact that net profits on sales have been halved, last year's net profit showing may still be subject to further downward readjustments, due to contract renegotiations.

Through efficient production methods, the industry over the past several years has been able to effect savings running in excess of two billion dollars, which have been passed back to the government. Continuation of this practice may further effect changes in the annual reports of the 21 parts companies and 15 motor vehicle manufacturers who have submitted their data to the Automotive Council for compilation into preliminary industry totals.

The figures for one company show that between 1940 and 1943 the net income after taxes, based on per cent of sales, dropped approximately 68 per cent. During the time this reduction occurred, gross sales, number of employes and annual payroll showed an increase.

Another company recently reported that since Pearl Harbor less than half the pre-war profit per dollar of business has been realized. In the five years prior to December 7, 1941, the company retained 5½ cents out of every dollar of sales; while in the first two years after Pearl Harbor, this was cut to 2½ cents.

Tooling Service Aid Extends Nation-wide

Long-Distance Appeal Secures Needed Dies

"ATLANTA, GEORGIA, CALLING," said the long-distance operator. A southern drawl with a note of worry in it came over the wire.

"We need dies to make 57 mm. steel shell cases—must have them in six weeks! We've canvassed tool shops all over the south, and as far north as Chicago without any luck. Can anyone in the automotive industry help us?"

Somebody could. Within an hour from the time the telephone call was received in the industry's Tooling Information Service Office an automotive tool shop with the facilities to design and build the dies had been located.

From a master list of 400 tool and die shops doing work with precision ratings up to one ten-thousandth of an inch, the tooling service located a shop with open capacity and referred the southern firm to it. The tool shop studied the order, recommended a total of 37 dies made up of 400,000 parts, and suggested the manufacture of certain spare die parts to avoid production loss through die breakage. Work on the dies was begun at once, and in a few weeks the southern firm will begin producing shells ahead of schedule.

Such an incident is typical of the manner in which the industry's tooling information service functions. Established by the Automotive Council for War Production just 24 days after Pearl Harbor, it serves 1,400 companies, many not connected with automotive manufacture.

The placement of billions of dollars worth of orders during the first weeks of war called for a clearing house to supply manufacturers with information concerning tool shops able to make gages, jigs. fixtures, dies and cutting tools. The Tooling Information Service, organized on a voluntary, cooperative basis, and open to any war manufacturer, was the answer.

During recent weeks more than 85 per cent of the orders received in automotive tool shops have come from manufacturers outside of the automotive industry; while requests for tooling aid have been received from war plants in such widely separated states as California and Rhode Island.

WEAPONS FOR TWO WARS

Automotive production methods—an omnipresent threat during World War I, perfected in the peace years—tip the Victory scales in World War II.

World War I saw the first large-scale Army use of motor vehicles.

"NEVER waste time. . . . Follow up successes with utmost energy. Only pursuit of the beaten enemy gives the fruits of victory."

Thus did the bleak and evil genius Carl von Clausewitz summarize the essentialities of successful warfare, and rise to cast his shadow 130 years ahead of his time, into the 1940's and the greatest of all world wars. His writings became the scriptures of German militarism and were interpreted to mean the use of the most modern conveyances to insure speedy transport, mobility and flexibility for armies in the field. Today they have been translated into mass use of trucks, tanks, jeeps, ducks, mobile guns and similar self-propelled war engines which embody the latest technical advances in the science of mass transportation of men and materials.

In World War I the centuries-old German drive toward world domination collided with an immovable obstacle the widely developed application of mass production techniques to the manufacture of war products.

The Kaiser's armies, the strongest in the world in 1914, were gradually reduced to a position of inferiority by an increasing flow of technically advanced weapons from the Allied countries arrayed against them.

Although the Germans had entered the war with superior equipment, and gave continuous heed to the advice of Clausewitz, their fortunes headed toward a definite reversal with the American declaration of war.

Despite its youth, the automotive industry was relatively as important in the economy of World War I as it is today. In 1917, the industry produced nearly two million vehicles of all kinds in an economy in which the national income was $50 billions annually and annual steel production was 40 million tons; in 1941 the industry produced approximately 4½ million vehicles in an economy in which the national income was $90 billion and steel production was 80 million tons.

For the requirements of World War I, it was fitted to the task of supplying armies with equipment superior to the enemy's. The industry took contracts totaling $1,100,000,000 covering a wide variety of war goods, including tractors, trucks, shells, gun mounts, mine anchors, gun carriages, depth bombs, bayonets, and other goods totaling 102 products, according to a report by the War Industries Board.

The coming of peace in November, 1918, forestalled a full-scale showdown on the production front between American and German-dominated producers. Thus the challenge had been only half met and mass production had been stopped in mid-stride.

During the "long armistice" between the two wars, automobile and truck production skyrocketed as better roads were built, faster and safer cars were manufactured, and American life became attuned to rapid movement on wheels. The industry expanded, and extended greatly its method of subcontracting the manufacture of parts to small producers throughout the nation, building up lines of supply from every state and from thousands of communities, to feed the vast production lines erected in new, modern assembly plants. Unending research was fostered, and practical advances were incorporated into cars and trucks from year to year.

The durable goods industries thrived in unison, as the automotive factories became the largest consumers of iron and steel, alloys, gasoline, rubber, plate glass, nickel and lead. Agriculture felt the effects, as the industry became a leading consumer of cotton, wool, mohair, hides, corn, sugar cane, flaxseed and turpentine. The machine tool industry expanded and whetted its ingenuity to keep pace with the annual demands of the industry for better tools to make new models.

Between the two wars the industry built 85,000,000 motor vehicles. In 1941 there were produced 4,800,000 cars and trucks, and eight times as many motor vehicles were in use as in World War I. Employment had jumped from 127,000 in 1914 to 513,000 in 1941, and wages had leaped from $101,000,000 annually to over a billion dollars as automotive workers consistently led the nation.

When war clouds covered Europe again in 1939, the Germans once more put the Clausewitz theories into practice only this time on a larger scale using more vehicles of greater variety.

More men, more vehicles, more guns per man, more bullets per minute, all operating in many theaters of war simultaneously, made it necessary for a military organization to be backed by a powerful, well-integrated mass production industry with special skills in automotive-type production.

Where a World War I infantry division required 153 motor vehicles and 4,400 horses, a World War II division requires 3,500 vehicles of 160 different types, and no horses at all. The war of wheels and horsepower had come, and, with Pearl Harbor the automotive industry again was thrown a challenge, larger than before, and more vital to the nation's welfare. Production—in volume, with speed, of high quality—was the answer to the challenge.

On February 10, 1942, the production lines came to a halt after seeding forth the last civilian passenger vehicles. While the Germans reigned supreme in Europe, threatened to engulf the Near East, the Suez Canal and Africa, and the Caucasian oil fields, again the seeds of their military defeat were being sown in mass production industrial plants. The automotive industry was asked to produce one-sixth of all war goods made of metal, including 75% of the aircraft engines, one-third of the machine guns, two-fifths of the tanks, over half of the Diesel engines, 100% of the military vehicles, and millions of tons of other items ranging from gyro-compasses and torpedoes to anti-aircraft cannon and complete aircraft.

Public's demand for cars aided industry's peacetime expansion.

The production sinews that had built 85,000,000 cars and trucks were expanded to even greater capacity, and then harnessed to an even more rapid rate of output. The industry's 1,038 peacetime plants become a cooperative unit, each aiding the other to get the job done as quickly as possible.

Two years after the last car was made, the industry had actually delivered $14,200,000,000 in war goods, and was at peak capacity, turning out tanks, engines, guns, military vehicles and other war products at the rate of $10,500,000,000 annually, just double its best peacetime rate. The equivalent of 194 squadrons of airplanes, each containing 15 heavy bombers, 30 medium bombers and 90 fighter planes had been produced. The industry had delivered to the United Nations the equivalent of 174 armored divisions, each containing 3,314 vehicles and tanks. Guns equal to a battery of 15,000 90 mm anti-aircraft guns and 465,000 .50-caliber machine guns had been completed. And production volume was continuing at the rate of over $1,000,000 per hour, day and night, without let up.

Today's equipment is built for specialized assignments.

Again the German military fortunes were reversed, as history repeated itself within 25 years. American, British and French armies mounted with General Sherman tanks and hordes of fast combat cars smashed Rommel in Africa and drove the Germans out of the Mediterranean, then took Sicily and entered the continent through Italy. Mighty Russian armies, bolstered by American aircraft and military vehicles that feared neither bitter cold nor soggy mud, drove the Germans from the Caucasus, the Volga, the Don, and finally almost entirely out of Russia. In the mountains of Yugoslavia even the guerrillas, using guns and equipment smuggled in or delivered by air, stopped the panzer divisions.

The admonitions of Clausewitz—"Use speed, be mobile, pursue the beaten enemy to gain the final fruits of victory"—these were being obeyed with a vengeance, but now dominance in a war of horsepower has passed to the armies of the United Nations.

Removal of Machine Tools Would Aid Plants

(Continued from page 1)

When the attack on Pearl Harbor dictated the complete conversion of automotive facilities, the plant layout men undertook a herculean task. With orders for new war products cascading in overnight, they faced many times the "model changes" experienced in a peacetime year.

Automotive machine tools not adaptable to war production were moved outside to stand in the snow, making way for incoming war production equipment. Plant interiors were ripped apart, concrete bases were filled, and the greatest physical upheaval in industrial history took place.

To cite one example, an automotive body manufacturer uprooted 80% of his total plant area. The productive machinery was either scrapped, stored or shipped to other plants that could use it. Not a single conveyor line used in body manufacturing was found suitable for the plant's new job of aircraft wing production.

While the plant was being reduced to four walls and a roof, the planning went on. Nearly a year passed before the wings began rolling out in volume. Six months of that time was needed to determine the most efficient arrangement of the productive facilities, to get the best location for power conveyor lines, and to install new machine tools and equipment for war production.

The planning paid off when volume production was reached. At a time when manpower shortages threatened to limit war production, this plant saved 14,500 manhours a month on its Flying Fortress wing-tip assembly; 18,700 manhours a month on the outer wing final assembly; 26,000 manhours monthly on the P-47 wing final assembly, and approximately 25,780 on the wing structure assembly.

Many factors were involved in the above manufacturing efficiencies, and detailed advance planning at the layout board is numbered among them.

In planning for reconversion, the plant layout man's problem will be different than in the pre-Pearl Harbor days. Before the outbreak of war, plans for re-arranging plants had to wait until the companies knew what type of defense products the government wanted produced. Once the nation was at war those decisions were made overnight in great numbers, and management acted with speed and dispatch in clearing automotive equipment from their plants.

In reconversion, the automotive industry knows what it is to manufacture: motor vehicles and parts. The various companies also know what equipment they need, but at present they face the stumbling block of what to do with the government-owned machinery that will occupy plant space after V-Day.

The industry has not been provided with a formula which it can follow after Victory in disposing of the government-owned production equipment in its plants.

Until this formula is devised and the way paved to move government equipment out of automotive plants, there can be no resumption of passenger car production in existing facilities. The speed with which employment can be provided in civilian manufacturing depends on the sound solution of this problem.

Many Nationalities Work in Industry

ALTHOUGH MOST of the nations of the world are at war—professing hate for each other—it is possible for a wide variety of races and nationalities of mankind to work and live peaceably together day after day.

Proof of this may be found in the automotive industry, where scores of foreign-born are working side by side to defeat the Axis. While the majority come from allied countries, there are many who have fled from lands with which America is at war.

At one automotive company alone, 29 nationalities or races are represented on the mile-long production line where dive bomber wings are built. They are: American, English, French, Chinese, Bohemian, Romanian, Italian, Syrian, Greek, Filipino, Russian, Jamaican, Czech, Negro, Yugo-Slavian, Croatian, Polish, Finnish, Bulgarian, Scotch, Irish, Spanish, Portuguese, German, Dutch, Belgian, Danish, Korean and American Indian.

Linguistic difficulties were encountered in very few instances and today only English is spoken along the line. Some of the Chinese men and women employed by the company were unable to speak English at first, so they were placed under leaders of their race for a short period.

All of the foreign-born employes of this company had to give proof of their American citizenship or loyalty to the United States before they could be hired.

Many of the workers have had unbelievable adventures in fleeing the tyranny of the Fascist countries. Such experiences have made these employes acutely aware of the importance of their automotive war production jobs.

Latest weapons emphasize speed and maneuverability.

Automotive Industry Develops New Weapons To Meet Requirements of Mechanized War

THE continuous striving of the world's armies to reach the highest possible degree of mechanization and mobility has resulted in a need for specialized combat weapons—many of them automotive types designed and developed for particular jobs.

Coming off automotive assembly lines in volume these days are two new weapons which emphasize the role of trucks and motor cars in modern war. They are, respectively, the M-16 or multiple anti-aircraft gun motor carriage, and the M-8, a tank-like vehicle somewhat larger than a jeep.

The recent appearance of these vehicles recalls the World War I period when trucks and automobiles first proved their value as weapons. Early in that conflict, the French rounded up all taxicabs in Paris, rushed the city's garrison a few miles to the front, and stopped the advancing Germans at the Marne—short of their goal.

A similar experience befell the U.S. Army in the Mexican campaign of 1916. When Pershing was sent to the border, not more than a dozen motor trucks were in the entire Army. Because the expedition had to travel light and fast, some 4,000 trucks and cars were picked up along the way. This was the first recorded American use of motor vehicles as engines of war.

From these episodes came recognition of the advantages of motor transportation in warfare. By 1917 the army had acquired 3,039 trucks and 437 automobiles. Eighteen months later it had 85,000 trucks as well as many cars and ambulances. At least 18,000 of the trucks were used in France for supply purposes.

Today, the U. S. Army is the most highly motorized and mechanized in the world. Its two newest vehicles, perfected in collaboration with the automotive industry, are the last word in their fields, and the result of a long line of developments.

The M-16 is in reality a half-trac, which evolved from the four-wheeled scout car produced by an automotive company ten years ago.

Originally, the scout car was used for reconnaissance work and the fast movement of personnel. But, as the result of field experience, many other uses were added to the basic function of the vehicle, until today it is an extremely versatile unit.

In its present form, the M-16 combines the mobility of the half-trac with the firepower of the most recent anti-aircraft developments—a four-barreled .50 calibre machine gun which synchronizes the fire of all four ports on a single target. The vehicle is capable of 50 miles an hour on level ground, while its endless belt track support at the rear enables it to traverse mud, sand or water up to two and a half feet in depth.

Among other uses, half-tracs have been employed most spectacularly as gun carriers for combat purposes. They have been equipped with mortars of varying sizes as well as field guns up to 105 mm. Mounting 75 mm. guns, for instance, they became famous as tank destroyers and were a contributing factor to Rommel's defeat in the African campaign.

The M-8, designed for scouting and long-range cruising, combines the maneuverability and speed of a modern automobile with the punch and armored protection of a light tank.

Automotive engineers and Army Ordnance representatives who designed the M-8 discarded the conventional type of armored car construction in which an armor-plate body is built on a truck chassis. Instead, they fabricated an armored hull which itself serves as a frame. Except for a turret, the vehicle stands less than five feet above the ground.

Resembling a turtle back in appearance, it is a six-wheeled, seven-ton vehicle that travels at high speed over almost any type of terrain and is capable of climbing a 45 per cent grade. It is equipped with a 37 mm. anti-tank gun and a .30 calibre machine gun which operates as a single unit.

The four-man crew is guarded by armor plate, with driver and assistant having protected vision through the use of steel shutters at four vision slots and by indirect vision devices called protectoscopes. Ordinary rifle bullets cannot pentrate the armor plate to hit gas tank, engine or occupants.

AUTOMOTIVE WAR PRODUCTION

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Automotive Council for War Production

New Center Building, Detroit 2, Michigan

First step in preparing veterans for industry jobs comes at Army hospitals.

Industry Speeding Rehabilitation Programs For Men Medically Discharged from Service

AN AUTOMOTIVE company, already the successful employer of over 1,000 medically-discharged World War II service men, has recently announced the establishment of a 300-acre camp where ex-soldiers may apply for and receive occupational rehabilitation. Those who complete this special course are not obligated to work for the company.

A second firm, with 13,000 discharged service men on its payrolls, has appointed committees composed of physicians, trained personnel men, and safety engineers to supervise the rehabilitation of returning veterans in its plants.

Daily production reports of companies throughout the automotive industry prove the inaccuracy of Webster's definition of the word disable—"to render unable or incapable."

Since the beginning of this war thousands discharged from the services for medical reasons have returned to their former place of employment and been placed on important production jobs; have regained confidence in their own abilities; have grasped the opportunity to continue the fight for Victory by producing equipment needed to assure the defeat of the Axis.

The programs of most companies at present are in the experimental stage, with new approaches to the problem being developed continuously.

Experience to date reveals that handicapped workers have an efficiency standard at least as high, and in some instances higher than that of the normal individual. And often the presence of a medically-discharged veteran inspires other employes to increased efforts.

Rehabilitation programs vary among the different companies in the industry. Some are based on peacetime programs which sought to utilize the talents of handicapped people in the production of motor cars. Others were developed to meet conditions brought on by war. Whatever the background, automotive management has assigned its top talent the job of providing disabled American fighting men with the best possible chance in civilian life.

Most programs consist of interviews with the returning service man, followed by thorough medical examination, classification according to physical capabilities, and assignment to work. Those who need no special attention are placed immediately. Others are given training and then assigned, while in extreme cases the companies work with the Veterans Administration until the individual is qualified for privately-conducted rehabilitation courses.

The automotive-operated rehabilitation camp is planned for men who wish to return to industry or farming. It combines work on farm lands and in a machine shop with classes in supplementary subjects.

Recreational counselors direct exercise periods as well as entertainment. A medical check-up is made every morning and the necessary treatment provided. In addition, each trainee is paid three dollars a day.

Another company has assigned a World War II veteran as a full-time veterans' counselor and contemplates broadening this policy, in the belief that men with battle experience are better qualified to help solve readjustment problems than counselors without this background.

Duties of these counselors include follow-up of the ex-service men's progress on the job, recommendations for transfers when found advisable, and talks with the men both on the job and at their homes.

A survey of jobs to determine suitability for men with various types of physical handicaps has just been completed by another automotive firm. The company's plan involves coordination between the medical department, the employment department, the director of training and the supervisory force so that as many returning veterans as possible may be placed on jobs they can perform without risk of injury to themselves or to other employes.

After a complete physical examination, a veteran is recommended for a particular job.

For example, men with heart ailments, serious visual defects, hand or arm disabilities are not assigned to work on hazardous machinery. Those with back injuries are not placed on heavy lifting jobs, those with lung ailments are kept away from work where dust and fumes are present, and those with leg injuries are assigned jobs that do not require extensive walking or standing.

As a variation, another company makes sure that each returning service man is greeted by plant officials, his former supervisor and associates in his department before he receives a formal employment interview.

The company also plans to give special attention to a veteran who, through acquisition of new skills as the result of military training, qualifies for a job higher than that which he formerly held.

AUTOMOTIVE

WAR PRODUCTION

Vol. III No. 6 Published by Automotive Council for War Production June, 1944

INVASION DAY was the result of years of faith—the faith of many peoples in the ideal that man shall be free to work out his own destiny.

That faith manifested itself powerfully in the "miracle" of the Dunkirk evacuation, wrought by a people determined to rescue their army—a "lost" army that now fights again. It was the sole armor of the English people in the Battle of Britain, in which so many came to owe so much to so few.

It was faith that enabled the Russian people to rally from terrible losses, to stand at Stalingrad when all seemed lost, and to hurl back the tide of Nazi tyranny.

This same powerful faith not only fired the American people's rapid recovery from the disastrous shock of Pearl Harbor, but became the shining light that caused other peoples to turn hopefully toward America for the fighting qualities and the productive ability needed to help set an enslaved world free again.

Faith in its own ability was responsible for the production performance of American industry when the need was greatest. The mountainous accumulations of military supplies and equipment now moving crushingly against the enemies of freedom attest to that.

Faith in its productive ability, nurtured through World War I and through the years of peacetime growth, was the source of that strength which enabled the automotive industry to undertake the manufacture of unfamiliar and highly specialized war products.

In the years since the American people summoned this industry to its wartime tasks, those weapons have been manufactured in huge quantities. Into their production have gone those qualities—extreme care, exacting workmanship, and restless research—which the unshackled hands of free people alone seem able to apply best to productive work. Those qualities are inherent in the battle equipment produced by this industry.

We, the people who participated in the production of that equipment, are confident it will meet this test—as it has already met the tests of earlier campaigns, in North Africa, Italy, Russia, the Near East, the Orient and the Pacific.

This industry will continue to outproduce the Axis nations, and to manufacture better and ever better products, to the end that victory shall come with the least possible loss of American youth.

With the free people of this nation, and all the world's people who would be free, we of this industry face the eventual outcome with FAITH.

ALVAN MACAULEY, *President*
Automotive Council for War Production

This supervisor suggested o new type fixture to bend oluminum tubing.

Workers Display Ingenuity with Suggestions To Help Industry Meet War Production Goals

AMERICANS are the "tinkeringest" people in the world. Just turn over a piece of machinery to a curious Yankee mechanic—he'll examine it, take it apart, put it together, discover why it "ticks" and sooner or later come up with an idea to make it function more efficiently.

Recently, for example, an automotive company encountered difficulty in the manufacture of fuel injectors for Diesel engines. In cleaning tiny holes in the unit, pieces of piano wire were tried, but results were unsatisfactory.

While cleaning his pipe one evening at home a plant supervisor hit upon the idea of using pipe cleaners to do the bothersome job. He tried them the next day and they worked well. As a result the company has been using ordinary pipe cleaners in a standard manufacturing operation ever since.

Before the company could set up the new operation, however, a way had to be found to buy pipe cleaners. At first, the supervisor sent his children to all the stores in the neighborhood without success. Finally the Navy, after detailing officers to investigate, approved a priority under which the plant now buys the cleaners.

Further concrete evidence that this tinkering trait has paid handsome dividends to the Nation's war production program is found in the engineering records of many automotive companies. These show that workers on all phases of production have contributed to the industry thousands of ideas, or suggestions, to increase deliveries of war goods, improve quality, reduce costs or save materials.

Although some companies had sponsored suggestion plans before the war whereby an employee was paid for a practical production idea, the need for large quantities of war material following Pearl Harbor intensified the programs throughout the industry.

Committees of experts in the various automotive plants study and test the suggestions. Those ideas that are practical win for their originators awards of War Bonds or cash, and in outstanding incidents the War Production Board issues honor certificates. Any cash savings which result from the application of the ideas are passed along by the companies in the industry to the consumer, at this moment the government.

One company reports that during 1943, approximately 20 per cent of all the ideas submitted by their employes were found practical. From a total of 125,000 suggestions, some 25,000 were put to work on war production, earning for their contributors awards in War Bonds amounting to nearly a million dollars.

Many times an employe's suggestion has made possible increased production on equipment badly needed by the Army or Navy.

At one automotive company, now manufacturing aircraft, production on Navy planes averages an hour and a half less time per ship as the result of an employe's suggestion.

An employe in another company suggested an adjustment on the bearings of a secret weapon. The change resulted in the delivery of 1500 more units to the Allies than was possible before the idea was contributed.

The War Production Board recently cited three employes of an automotive company for a series of suggestions which resulted in the saving of 15,539 man-hours a year on the production of Army carbines. In addition, the ideas increased the number of guns delivered each day and will ultimately effect a saving of 250,000 rounds of ammunition for the Army.

One of the ideas called for a small V-type adapter which slips over the rear sight of the carbine. This enables the man firing the gun to adjust the wind drift indicator correctly and accounts for the estimated ammunition saving. The other ideas were concerned with improved methods of machining trigger barrels.

As one automotive executive recently said in reviewing the suggestion program: "It's pooling the thinking of the sweeper and the general manager and everyone in between."

Worker demonstrotes his ideo.

Conveyorization of aircraft nacelle production helps save 8,650 man-hours a month.

Industry Boosts Production of Aircraft Parts When Special Conveyor Systems Are Installed

CONVEYORIZATION, the rapid and efficient handling of industrial materials in volume, is prominent among several factors which have been combined to make an automotive company one of the world's largest producers of hydromatic aircraft propellers.

In another instance a former automobile body manufacturer has relied on new-type conveyors to forge ahead as a leading supplier of wing-tips and engine nacelles for the Thunderbolt and Flying Fortress.

These accomplishments are the result of answers found for problems faced by many other companies in the industry when they were building up and expanding productive capacity in an effort to meet the tremendous goals set for them after Pearl Harbor.

The company which now manufactures propellers converted two old, multiple-story buildings into a modern war plant. To utilize the space most efficiently it was necessary to select and mount suitable materials handling devices. Among those chosen were monorail conveyors which carry the propellers one and three-fourths miles from one manufacturing operation to another, permitting the plant to step up its production nearly fourteen-fold.

During the conversion period, the former body manufacturer uprooted peacetime machines and assembly lines covering an estimated 80 per cent of the total plant area. In the process of tearing out automobile equipment, it was found that not a conveyor line designed for body production was suitable for the aircraft program.

Once war production got under way, the savings in time effected by the specialized conveyor system and other production techniques proved to be spectacular. Approximately 4,680 man-hours a month are saved on the fire-wall, longeron and beam assembly of B-17 engine nacelles; some 12,620 man-hours are saved on the wing-tip framing line; and more than 3,740 man-hours are saved on the nose section final assembly line.

This problem of handling materials has confronted and puzzled both engineer and workman alike since the dawn of history. In ancient Egypt, the building of the Pyramids was eased by mounting the huge stone blocks on wooden rollers.

Only 20 years ago, effective materials handling devices were comparatively new in industry. At that time, for example, automobile axles were manufactured by hand on rows of long tables and moved by human power. Then it took 1100 men eight hours to turn out approximately 500 axles. When a rude conveyor system was installed in the tables, production jumped to around 1900 axles every eight hours.

Modern progressive production methods grew from this experiment. In the years following, automotive manufacturers became widely recognized as the nation's outstanding example of an industry utilizing the best in plant lay-out, sequence of operation, latest-type equipment and economy of time and money in the movement of supplies.

Research in the industry, which accompanied these developments, showed that "90 per cent of making is moving." Another fact revealing the value of materials handling equipment shows that two decades ago industry's internal freight bill exceeded the external transportation charges of raw material from mill to automotive plant.

The peacetime results of the unanimous adoption of conveyor systems and similar devices, with their attendant saving in production time are visible in the thousands of low-priced automobiles on the nation's highways. In war production, where new types of conveyors have been utilized to meet special manufacturing problems, the results of conveyorization can be seen in thousands of tanks, planes, aircraft subassemblies, trucks, landing craft and other equipment which participated in the historic European invasion.

One of the outstanding production achievements of the war has been recorded by the automotive industry in the manufacture of tanks. By using automotive assembly line methods, where raw materials come in one end of the factory and flow out the other as finished products, one company alone has produced more than 11,000 tanks and tank destroyers.

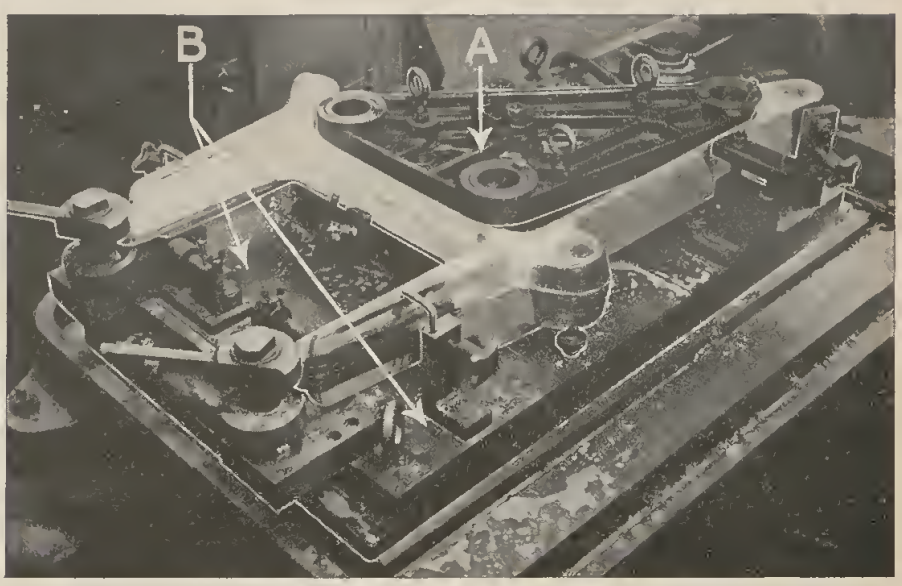
To accomplish this, the company installed a special conveyor system powerful enough to pull a 30-ton vehicle. Two lines, approximately 900 feet in length and costing $115,000 to install, resulted in increased deliveries to the armed forces and played a major part in helping to reduce the cost of tanks to the government.

Conveyorization has also proved effective on other types of war products manufactured by the industry; shell cases for example. One automotive company installed a system which replaced 27 operations and released 12 men for other war work in the plant, besides saving considerable floor space and permitting a smoother flow of raw materials to adjacent operations.


THE PIPELINE OF SUPPLY
SUPPLY DEPOTS
BASE SUPPLY DEPOT
ADVANCE SUPPLY DEPOT
W
E
S

JIGS AND FIXTURES: These Are the Tools Which Enable Industry To Build Complicated Products in Volume

This is the aluminum forging out of which will be made one of the important wing-support frames for the folding wings of carrier-borne dive bombers.



The frame is locked into a FIXTURE (B) with clamps, to insure that it will be in exactly the proper position for the first work to be done on it. Then a JIG (A), the triangular piece of metal outlined above, is clamped down in the desired position. The FIXTURE will hold the product, and the JIG will guide the tool accurately.

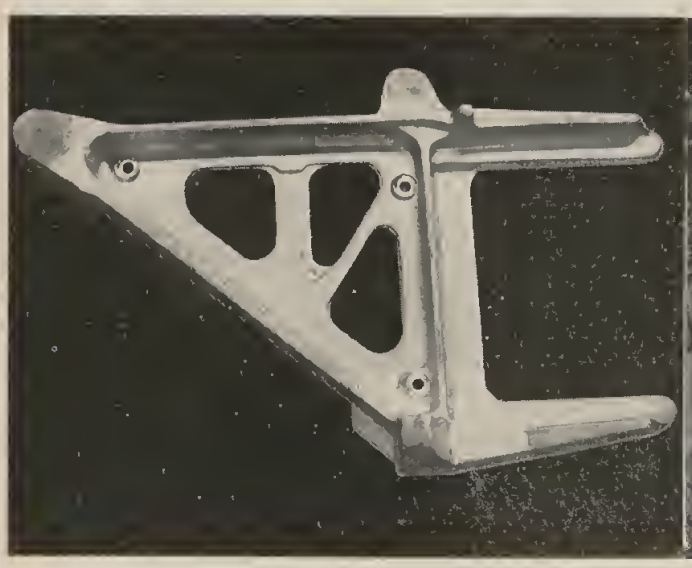
Two of the important keys to mass production are called "jigs" and "fixtures." Combined with tools and machines, they are responsible for the ability of the automotive industry to manufacture thousands of complicated products, each part of which must be drilled, planed and shaped in exactly the same way as its predecessor.

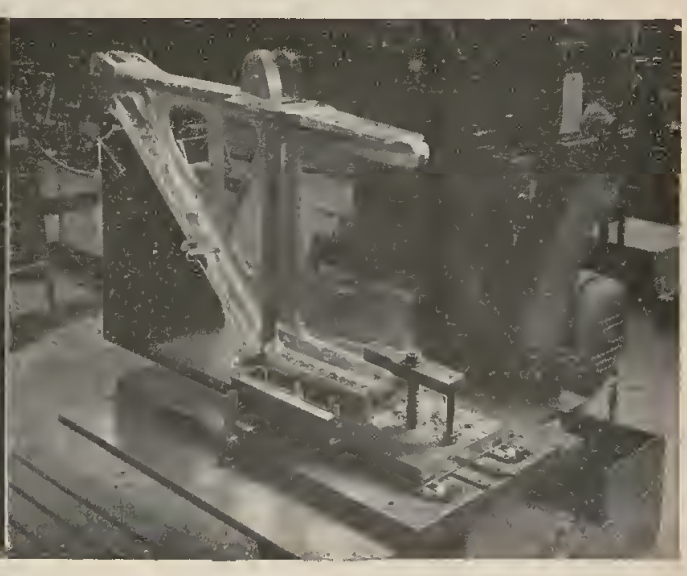
The jigs and fixtures illustrated, as well as many other tools and machines used on war production in the automotive industry, are specially made for the manufacture of special products. When circumstances alter the demand, and there ceases to be a need for the product this special equipment becomes obsolete and must be scrapped.

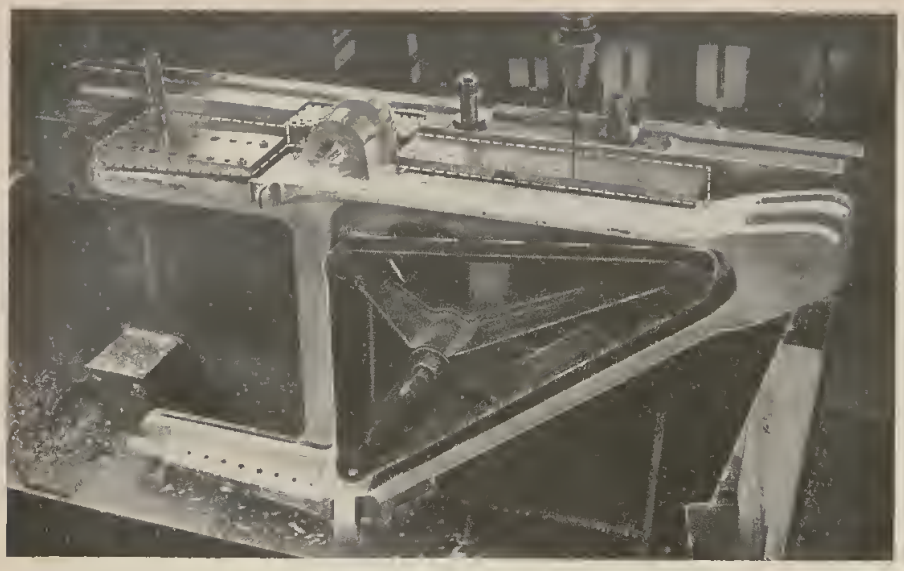
Broadly speaking, a fixture may be defined as an apparatus designed to hold the piece of material on which work is to be done. The jig may similarly be defined as an apparatus designed to guide the tool which will do the work. Both jigs and fixtures must be highly accurate, and being quite generally used in combinations

Guided by the JIG, a drill bores three locating holes in the frame. These holes will locate the place of measurement which will in turn determine the location of subsequent work.

After passing through a series of operations during which 86 holes of various sizes have been drilled, the frame is locked vertically in a FIXTURE for further drilling operations.







In a final stage, the last af 283 hales are placed in the frame, again held rigidly in a FIXTURE, while the drill is guided in turn by three different JIGS, as outlined by the datted lines in the picture. The hales range fram .173 ta .250 af an inch in diameter, and eoch must be accurate ta a tenth af a thausandth af an inch.

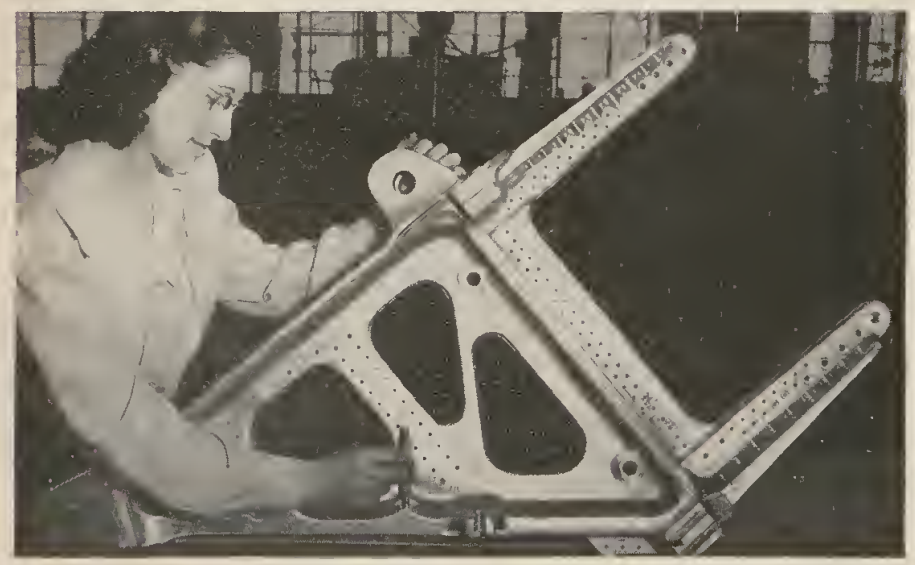
with one another, they supplement one another's functions.

Both are highly variable as to size and shape. The fixtures required in the making of bomber wings, for example, may be 100 feet long and 30 feet high, and may cost as much as $50,000 each.

Their applications are many. Fixtures may be used to hold material of almost any size, in almost any position. Jigs may be used to guide almost any type of tool in almost any type of function—cutting, reaming, countersinking, drilling, slotting, to name a few. Yet, any ten identical parts of any product, placed in the same jig and fixture assembly and drilled in the same way, will have identical holes of identical sizes in identical positions when the drilling is finished.

As the accompanying pictures demonstrate, this ability to produce identical parts in quantity, with accuracy, and at great speed through the use of these mechanical aids to human hands is one of the factors that makes possible the progressive manufacturing of complex products either in war or peace.

After 51 aperatians, wark an the frame is campleted, and an inspectar gages the 283 hales befare dispatching the frame ta the paint where the dive bambers are assembled. Camplete interchangeability af parts is readily assured by this pracess.



Mobile Clothing Store Serves Twenty Cities

Unique Truck Travels Southern Coal Fields

NEARLY everybody is familiar with some of the novel ways in which motor trucks are filling unusual wartime assignments. There are traveling libraries in rural communities, mobile Red Cross Blood Bank units, Army and Navy clubmobiles, to mention only a few examples.

Now comes a clothing store on wheels, a completely equipped motorized shop which travels the coal fields of Logan, McDowell and Wyoming counties in West Virginia. Operated by a mining company for the benefit of its employes, the store serves approximately 6,000 families in 20 cities.

Known as "fashions to your door," the unit visits each of the communities, all located within a 65-mile radius of the company's headquarters, for two or three days each month. Employes may purchase custom-tailored clothing or be fitted with ready-to-wear styles.

The store is housed in a large six-wheeled truck, and carries a standard line of 100 men's suits, 150 dresses, as well as ladies' suits, overcoats, fur coats, top coats and sport jackets. It is estimated by company officials that approximately 20,000 adults patronize the "fashion trailer" during each trip through the territory.

The service was inaugurated in 1937 after the company realized that many miners lived in out-of-the-way homes and isolated villages, and had no opportunity to shop for stylish, quality wearing apparel comparable to that found in city shops.

With longer working hours and the restrictions imposed on cilivian activity as the result of the war, the idea has proved to be a time-and-travel-saver for the employes. In addition, the workers like the personal service they receive from the top-notch tailor and dressmaker accompanying the unit.

Company officials report that sales in the "fashion trailer" range from $2,000 to $4,500 a week. The prices charged compare with those found on merchandise in independent and chain retail outlets.

The service has proved so popular in towns throughout the area that the advantages of the traveling store are not restricted to company employes.

New Type Ammunition Made by Motor Firm

Buck-Shot for Pistols Issued to Servicemen

If Captain Eddie Rickenbacker and his life-raft companions had been equipped with the armed forces' latest type weapon for self-preservation, their ordeal in the South Pacific would have been less exacting.

This new weapon, one of the most prized pieces of equipment currently being issued to American service men stationed overseas, is a package of buck-shot shells designed to fit a regulation .45 calibre pistol.

A few rounds of these shells augmenting regular ammunition minimizes the threat of starvation to sailors cast adrift from a sinking vessel, soldiers isolated in a deserted country, or airmen forced down in a remote jungle. As long as gulls, fish, birds, or small game come within a 40 foot range, the stranded service man is able to bag wild food.

The shells, now being produced in volume by an automotive company, are a combination of a regular .45 calibre steel shell case and a special capsule composed of three layers of paper pressed together and held tight by a new kind of paste. Fitted into the case, the capsule takes the place of the usual steel or lead missile.

Inside the paper container, lacquered red to distinguish it from other types of ammunition, are approximately 135 tiny lead shot. These are similar in appearance to the ones used in some shotgun shells. The steel cases holding the paper wads are manufactured by a process which the automotive company helped the army develop.

Grooves inside the shell case hold the paper nose in place. When the gun is fired the paper wad is discharged, in turn disintegrating and allowing the shot to scatter in a large pattern. These pistol-sized buck-shot shells enable a lost service man to hit targets that could not possibly be stopped with the ordinary high speed, single shot ammunition. To date, the automotive company has manufactured more than 4,000,000 of the shells.

To prevent errors occurring during the selection of ammunition in the field, the buck-shot shells are packed in specially-designed containers.

Paddles attached to truck wheels agitate dust in test room.

Effect of Sand on Military Vehicles Studied By Automotive Men in 'Dust-Bowl' Laboratory

Just as training under simulated battle conditions prepares a soldier for front-line duty, so rigorous treatment under simulated climatic conditions develops trucks, tanks and other military vehicles for combat operations.

Specially-built research laboratories, where automotive engineers conduct exhaustive tests, assure that the Army's mobile equipment will perform efficiently in a blizzard on the Alaskan Highway, a sand or dust storm on the desert, or in the dampness of a tropical jungle.

Recently an automotive company announced the operation of a "dust-bowl" laboratory where the effects of sand and fine dust on the life of mechanical parts will be tested. Necessity for such research arises from desert warfare, where extraordinary burdens are placed on air cleaners, grease seals and connections as well as from the military practice of driving over dirt roads in long convoys, which introduces dust problems foreign to ordinary travel.

In the test room, vehicles are mounted off the floor and operated by remote control from a sealed booth. Almost any wind velocity and dust intensity can be churned up in the "bowl" through a series of air induction jets and miniature windmills. To obtain extreme agitation of dust particles, truck wheels are fitted with four bladed paddles.

The simulation of actual driving conditions is accomplished by eccentrically weighting the vehicle's wheels and equipping it with extremely light springs. This allows the wheels to bob up and down as they revolve, exactly as though the truck were traveling over rough terrain. The wheels are brought to a speed of 35 miles per hour for five minutes, then braked to a stop.

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SURPLUS WAR MATERIALS

ACRES of parts, yards full of scrapped items, mountains of idle raw materials—these are some of the physical obstacles that threaten to bar the nation from an easy transition to a peacetime economy when the war ends.

After V-Day, when the automotive industry again turns to satisfying the demand for new cars, one of the first requirements before it can resume a civilian manufacturing program is unencumbered plant space in which to set up production and assembly lines.

If government-owned war materials clutter the aisles, crowd the shipping docks, and clog needed factory buildings at that crucial time, the premium opportunity for quick reconversion and speedy reemployment will be missed.

Even now, production cutbacks and war contract cancellations have caused huge stacks of obsolete war materials to accumulate in some automotive plants, tying up valuable manufacturing space. With each new contract termination (there have been $14 billion in cancellations to date), and with design modifications on war products, these stacks continue to grow.

In an industry where plant space is always closely calculated, the situation now developing is paradoxical, for the whole automotive assembly system is built around the even flow of materials into the plant as needed. There never has been room for maintaining surplus inventories.

In peacetime usually not more than a day's supply of one item or a week's bank of another was kept on hand.

At present, in a few instances, this practice of controlling production flow is being reversed. Materials which no longer are needed for war production and which have no relationship to those used in automobile manufacture are occupying valuable plant space. The current condition threatens to become one of the stumbling blocks to reconversion because of inability to get the materials quickly out of the way. The government, which owns these materials, has not established procedures needed for quick disposal of these surpluses.

In one automotive company, for example, as much as 30 acres of space, indoors and out, is occupied by parts and materials from a cancelled tank contract. The original production schedule called for 7,040 armored vehicles, but after 2,728 had been manufactured, operations were ordered stopped.

Left over from the tank job were 13,783 tons of high grade steel valued at $758,065, or about $55 a ton. When all plans to dispose of the entire lot

(*Continued on page six*)

Automotive Industry Demonstrates Versatility in Conversion to B-29 Superfortress Production

SPECTACULARLY executed, the two bombings of Japan's big Yawata steel works and other mainland targets by B-29 Superfortresses were the last links in a chain of steps that had been planned for many months by both the United States Army and American industry.

More than a year ago, automotive engineers were working on the conversion of their plants from the manufacture of one type of aircraft product to another twice as large.

The planning spread over uncounted sleepless nights as production men wrestled with plant layout problems and designed new jigs and fixtures, some as large as a railroad box-car.

It meant that thousands of workers, skilled and trained to perform one type of job, had to be taught new techniques. It meant that people who never before had worked in factories had to be trained from scratch.

It called for a type of conversion similar to that faced by the automotive industry in 1941 when war production supplanted peacetime production. The fact that new plants were built, old plants switched from the mass manufacture of one type product to the mass manufacture of another in record time, and with a minimum loss of working hours to employes, testifies to the versatility of automotive management and workers.

For example, one company, which manufactured fuselages for Marauder bombers, recently announced that between the time the last medium bomber part came off the line, and the shipment of the first B-29 section, a period of just 19 days elapsed.

The automotive industry is giving the aircraft industry substantial aid in the herculean job of producing the B-29. Five major automotive companies supply many of the principal subassemblies.

One company turns out most of the powerful 2200 horsepower radial engines used to drive the new sky giant. Another makes pressurized tail gunners' cabins and other fuselage sections. Wings and wing tips are produced by a former automobile body manufacturer. A former passenger car builder now makes engine cowlings and nose sections. In addition, some 150 former parts manufacturers and suppliers make lesser subassemblies.

As a case history of the problems encountered by the industry in converting to B-29 production, the example of the company which now makes nose sections, wing sectors, and engine cowlings is typical. Prior to the present production program, this company had been producing major subassemblies for a medium bomber.

A complete changeover in operation was called for, with the conversion job presenting a two-pronged challenge to managerial skill and agility in handling quantity production. Because of the tight manpower situation and the urgent need for the new aircraft, conversion to B-29 production had to be carried on as deliveries were being reduced on medium bomber assemblies.

In effect, as the last Marauder subassembly moved along the production line, old manufacturing equipment was torn out behind it and the new B-29 equipment installed.

The planning and organization of this conversion program was in the hands of a small group of highly skilled men—in reality an industrial task force. The group included a handful of engineers, a score of specialists in scheduling and product specifications, and about 40 members of the master mechanic's staff.

During the hot days of August, 1943, studies of B-29 blueprints and specification charts were made behind closed doors by the group. In their mind's eye, the big square fixtures and other installations on the 62 working stations of the medium bomber line were disassembled and in place of this manufacturing equipment the tools needed for B-29 production were envisioned. Long hours were spent in charting the most desirable routing system for materials and parts in process, and in estimating the man-days of work to be used in the changeover period.

Under the medium bomber contract the company had been making nose sections, center wing sections and wing flaps. This involved the manufacture and assembly of 17,000 separate parts, some obtained from 430 subcontractors. On the B-29 contract the production experts found they would require about 9,000 separate parts, some more than 40 per cent larger than those on the medium bomber.

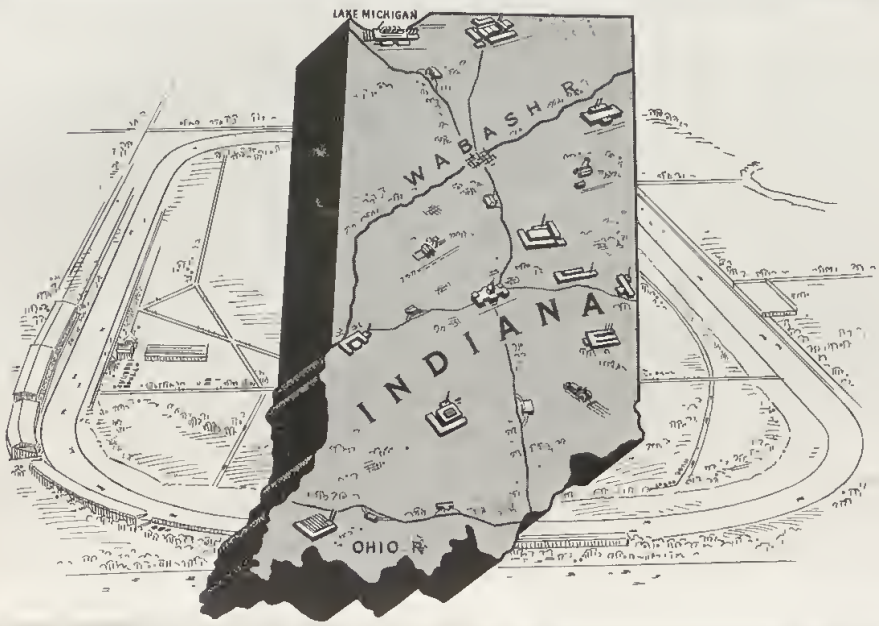
This difference in product size called for the most economical use of available space, and extremely deft engineering of the product and parts flow.

By October, 1943, the job had been broken down into parts and working operations, and materials were arriving in the plant. A month later, orders were being placed with 321 subcontractors. In December the company began the first B-29 assembly work,

(Continued on Page 6)

THE AUTOMOTIVE STATES — NO. 1 OF A SERIES

Automotive Industry Provides Jobs and Creates Wealth In Hoosierland



STRETCHING SOUTH from Lake Michigan to the broad Ohio River is Indiana—a mighty contributor to democracy's arsenal as well as to the nation's breadbasket.

Famed for its poets and politicians, scholars, scriveners and songwriters, the Hoosier state also has contributed a generous number of automotive pioneers—inventive, industrious men, who have helped make America in war or peace the greatest producer of horsepower in the world.

As an automotive manufacturing state, Indiana in peacetime produced $252,000,000 annually in durable goods for the automotive industry. In pre-war years, more than 50,000 wage earners —equal to the total labor force in such Hoosier cities as Fort Wayne or Gary or South Bend—drew their paychecks as the result of jobs in motor vehicle manufacturing, parts and tire manufacturing and petroleum refining.

Wages amounting to $52,000,000 annually were paid by Indiana's automotive plants before the war, and this combined payroll was equal to 12 per cent of all the wages paid industrial workers in the state.

In wartime, Indiana is a busy workshop producing weapons for the United Nations, and its industrial payrolls are nearly twice the pre-war rate.

Yet when Indiana joins other states in going back to peacetime pursuits after the war, its automotive activity should form a healthy background for the state's continued economic progress.

For in addition to those people employed directly in manufacturing in 1940, there were approximately 166,625 men and women engaged in jobs in Indiana growing out of the sales, service and use of motor vehicles.

Additional employment, too, was created through the sale of $89,000,000 in petroleum products and similar commodities by 8,252 gasoline stations.

Motorists in Indiana contributed $40,000,000 in state taxes in 1940. They have seen their Hoosier highway system increased by a fifth in the past decade, and have watched it grow into one of the most modern in the nation.

Prosperous industrial conditions in Indiana have contributed to the economic well-being of the state's farmers, whose agricultural sales rank ninth in the country. In turn, Hoosier farmers are great users of passenger cars, some 397,000 being registered on farms and in unincorporated areas.

When passenger car production was suspended by government order after Pearl Harbor, Indiana was manufacturing or assembling cars, trucks and parts in 66 different automotive plants.

The ability of these plants and their suppliers to provide employment quickly in the period following the war may depend on the speed with which the factories can be cleared of government-owned machines and materials following the termination of war contracts.

The whirr of automotive machinery in Indiana following the war will continue a great Hoosier tradition for making units of transportation. A South Bend wagon-making company, a builder of prairie schooners for the '49ers, became a pioneer automobile concern, which today is devoting its talents to manufacturing aircraft engines for Flying Fortresses.

The birthplace of many of America's first cars, Indiana today continues to pioneer better internal combustion units. Powerful liquid-cooled aircraft engines designed and built by an automotive company in Indianapolis are currently making aerial history. Nearby are the plants of another enterprising automotive manufacturer who has turned out armored vehicles for unusual desert uses.

Indianapolis, too, is the home of the Speedway, internationally famous testing ground for motor vehicles over the years.

In Evansville an automotive company manufactures bullets; Anderson is producing aluminum castings, parts for aircraft and military vehicles and machine guns; Kokomo makes radios for the Signal Corps; Muncie and Bedford contain large aluminum foundries; Fort Wayne makes Army trailers; and South Bend turns out military vehicles.

AUTOMOTIVE JOBS IN PEACETIME INDIANA

Manufacturing	50,051
Federal and State Roads	6,700
Truck Drivers	118,100
Bus Drivers	5,600
Automobile Repair Shops	3 500
Motor Vehicle and Parts Dealers	11,795
Gasoline Filling Stations	18,334
Automotive Wholesalers	2,596

THE LEDO ROAD

●

New Lifeline to China Being Pushed Through Asiatic Jungles with Aid of Motor Vehicles

Tartuaus curves and blinding dust plague drivers on the Leda Raad.

NOT since our pioneering ancestors broke the trails into the trackless western wilderness with their Conestoga wagons have American-made transport vehicles met difficulties comparable to those of the Ledo road.

Day after day, hour after hour, the motor vehicles used on this all-important stretch of highway through the jungles of Burma face tests of stamina under conditions such as no equipment was ever designed to endure.

Yet, like the prairie schooners whose wheel-ruts through forest and swamp, and over mountains and desert, tied this nation of scattered, isolated communities into a unified whole, the American-made trucks, troop carriers, jeeps and other mobile units, are bringing physical unity to that fighting front of tremendous distances and forbidding terrain; the China-India-Burma theater of operations.

From supply depot to advance base, the road presents a truck driver's nightmare. Terrifying road shoulders, tortuous curves and blinding dust make up a few of the hazards presented to both men and machines. In addition, there is always the danger of a sudden mountain land-slide, a rain that washes the road over a nearby cliff, or mud that bogs a truck into uselessness.

Road building equipment is serviced in jungle camps.

Beginning at Ledo, India, in Assam's Naga Hills district the road pursues a generally eastward direction, running along the southern slope of the Himalayan mountain range through some of the world's densest jungles. After crossing the Burmese frontier, the road—or rather the route mapped out for it—winds in a southeasterly direction along the eastern side of the India-Burma border.

Ultimately it will be extended many times its present length to connect with the enemy-free portion of the old Burma Road, making a new lifeline from India to China.

Already large fleets of trucks, manufactured and shipped by automotive plants many thousands of miles from India, are delivering supplies over the Ledo Road to Lieutenant General Joseph W. Stillwell's troops fighting in the Hukawng Valley. These convoys are formed in the village of Ledo, terminus of the only rail line joining this part of Asia with seaports on the Bay of Bengal, and dispatched on regular schedules to the road's "Dead End" —and the front lines.

For both American men and American-built vehicles the construction of that first 100 miles of road represents a triumph over so-called "insuperable" difficulties. The engineers who super-

Near the front lines, the Ledo Rood becomes o one-lone dirt troil.

vised the operations had to battle malignant malaria and monsoon rains which average 100 inches in a year.

For American equipment the road represents a triumph over the thickest, wettest jungles in Asia, mountain ranges towering from 3,000 to 5,000 feet above sea level, and tangles of centuries-old hardwood trees, strangler vines, bamboo, elephant grass and banana palms.

Construction started in December, 1942, and was kept a deep military secret for many months. Indian leaders said it "couldn't be built." Today the Ledo Road is wide and smooth enough to accommodate truck traffic in two directions over most of its distance. Near "Dead-End," however, it is little more than a trail hacked through the wilderness. At this stage, trees are felled and bulldozers crash through to break a path for the trucks lined behind.

From the start 18 months ago, trucks were on the scene moving supplies of wood and canvas for base camps, carrying road building equipment, transporting gasoline, food and other necessities.

In the beginning there were only fifty trucks, fifteen rock crushers, five steam-shovels and several small bulldozers. Today, American and Chinese construction crews use the most modern equipment manufactured, and the hundreds of vehicles that make up the road's traffic have been brought more than 16,000 miles by rail, sea and air.

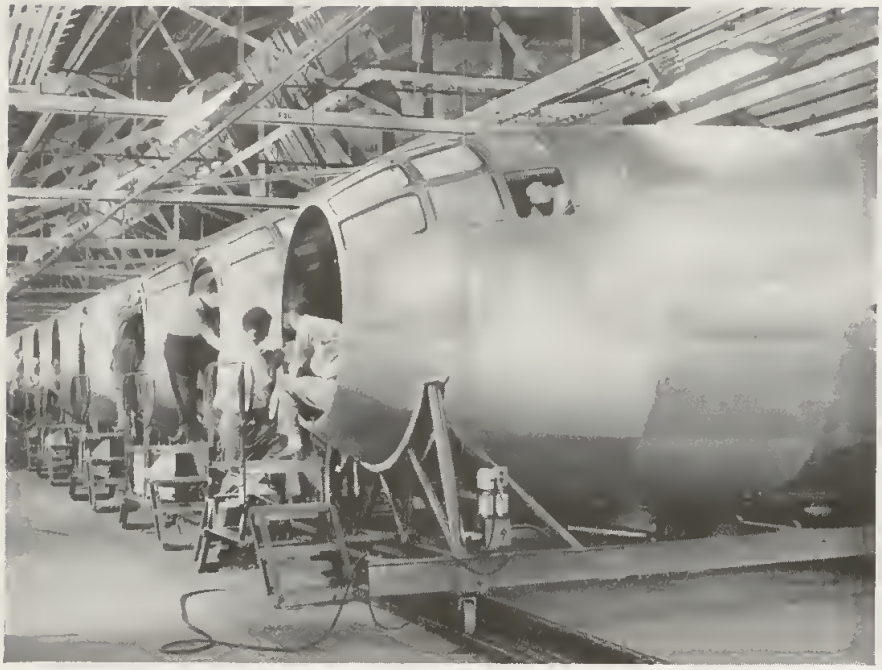
Like the road used by the American Pioneer's Conestoga wagons, the Ledo Road was in use while it was being built. As soon as the first bulldozer cut a trail, motor vehicles began carrying supplies to the fighting front. Often that front was only a few yards ahead of the construction crews. Much of the time, both trucks and the men who drive them were under direct shell fire, or bombing from the sky.

Even now, while traffic flows both ways, the work of widening, straightening, grading, filling, bridging and draining goes on. The work never stops. At night it is performed in the light provided by Diesel oil set ablaze in drums alongside the road.

To keep traffic moving, Army Ordnance maintenance depots have been set up along the way. When a truck has been damaged beyond repair, it is "cannibalized" and the parts thus recovered are used to keep other trucks and vehicles rolling.

The road is now over the "hump." The hill country of Burma has been conquered. The jungle highway is beginning to pay dividends as American-built trucks carry increasing amounts of machine guns, artillery, small arms, ammunition, clothing and other war equipment to the Chinese and American jungle troops facing the Japanese.

Bulldozers crosh through jungle to breok o poth for trucks ot "Deod-End."



B-29 nose sections ore volume-produced by on outomotive compony.

Industry Displays Versatility in Conversion

(Continued from Page 2)

and in January, 1944, six months after the conversion program got under way, the first finished B-29 parts were shipped.

The smooth transformation from one production job to the other is reflected in the company's employment and work assignment records.

At the time conversion plans were being drawn up, company officials, making every effort to avoid a complete shutdown of the plant during the changeover period, put their best planning men to work on the problem. Much was at stake. For as trained production workers were in great demand, there was concern that many workers would drift away if a shutdown ensued. This would entail training an entire new force of employes, with resulting delays in B-29 production.

Employment on the medium bomber production program totaled 3,000 persons, of which 2,400 were regular employes with seniority standing and 600 were new employes who had worked in the plant less than six months.

During the period of gradual changeover there were layoffs of the seniority employes during only three months, and then in a number which did not exceed 12 per cent of the total seniority roll. At no time were more than 32 per cent of all employes without work, and the average layoff during the entire period of the changeover was only 18 per cent.

The work assignment records show that during October, November and December, 1943, the number of workers assigned to the medium bomber production program gradually declined while those assigned to the B-29 job increased.

January, 1944, was the pivotal month. Then it was found that 55 per cent of the workers were assigned to B-29 production, while 45 per cent remained on the medium bomber. The months of February and March saw the cycle completed with the last medium bomber parts shipped in the latter month and the working force assigned exclusively to Superfortress production.

As the months passed and the B-29 production flow responded strongly to the well-laid plans of the engineers, materials experts, and their associates, the manpower side of the story was evidence that industrial know-how influences the success of all aspects of a production job.

Two months after the changeover was completed, the company recorded in its history of the B-29 project that production was running two weeks ahead of schedule on all assemblies.

Surplus War Materials Threaten Reconversion

(*Continued from page one*)

failed, invitations were sent to 7,000 steel users asking for bids on the material, item by item, and approximately 5503 tons were disposed of at an average price of $48 a ton. The remainder of the steel was tying up space in the company's yards nearly ten months after it became a surplus commodity.

In other categories, the company found itself with a large inventory of specially designed machine tools, jigs and fixtures, and precision gauges and measuring instruments. Outside of machine tools, only a small percentage of the equipment was usable on other war production work and none will be adaptable to motor car manufacture. Since the conclusion of the contract this specialized equipment has been boxed and placed in company-owned warehouses or yards.

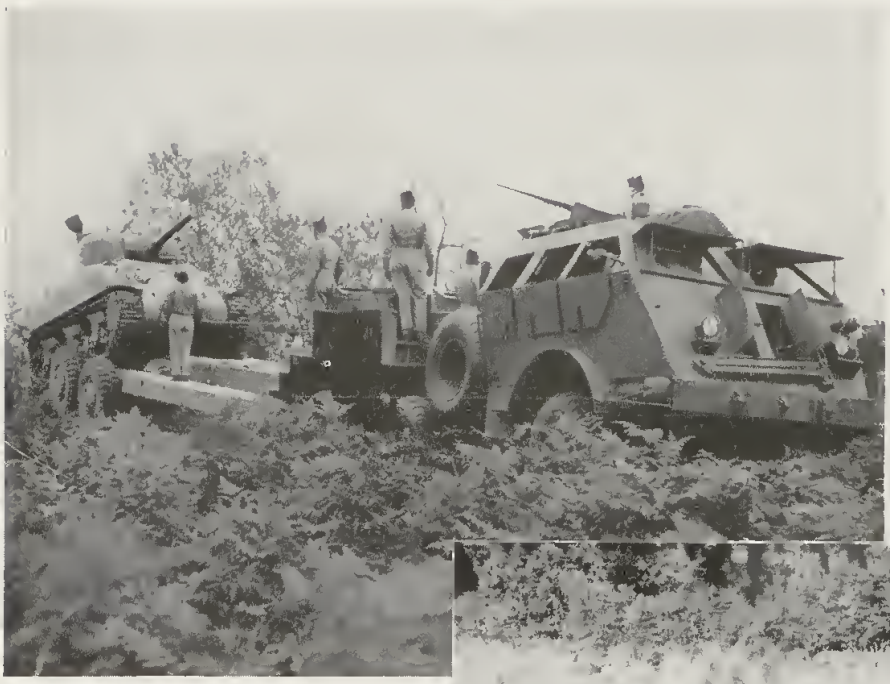
Among the surplus items are 2,691 jigs and fixtures with a value of $8,000,000; 4,347 special tools such as drills, cutters and reamers with a valuation of $5,000,000; 14,285 precision gauges and measuring instruments valued at $520,000.

The inventory turned up similar facts on such items as machine tools, dies, foundry moulding equipment, and even partially fabricated tank parts. It showed there were 1518 machine tools with an estimated value of $11,000,000; 1,200 metal dies costing $2,500,000; 2,063 foundry items worth $4,000,000; and 923 completed tank parts worth $12,000,000.

While not entirely typical of the surplus problems throughout the industry, this case history illustrates one possible source of industrial postwar stagnation. Many people will recall that the disposal of surplus material was a problem which plagued the nation for several years following World War I. With the signing of the Armistice on November 11, 1918, war production came to a halt. Guns, trucks, ships, tanks, food, fuel, clothing, all desperately needed a few weeks before, became surplus commodities.

Disposal problems similar to the above example will be multiplied many times with wholesale contract terminations. There is a realization that if factory space is allowed to become jammed with surplus goods, reconversion will be delayed and widespread unemployment will result.

WAR ON WHEELS



As Brigadier General Julian S. Hatcher, Office of the Chief of Ordnance, has said: "This is an automotive war. . . . The common denominator of all continents and climates today is the military motor vehicle of American design and build." This fact is continuously demonstrated on the battlefields of the world by United States and Allied troops, with the aid of a large variety of motorized equipment.

The term "motor vehicle" includes all wheeled, track-laying and combined wheeled and track-laying vehicles and chassis, designed for use on roads or cross country, which derive power from a self-contained internal combustion engine, *and all trailers and trailed loads towed by motor vehicles.*

TOP: This 6 x 6 armored tank recovery unit (six wheels, oll of which are power driven) recovers from the bottlefield damaged tanks and moteriols weighing up to 80,000 pounds. RIGHT: The versotile Jeep is acclaimed as one of the outstanding innovations in this war.

LOWER LEFT: Amphibious tanks provide armored protection for troops during landing operations. LOWER RIGHT: Six-wheel-drive, heovy-duty general purpose trucks are the most widely used vehicles in the armed forces. They have o top speed of 45 miles on hour as compared with 12 miles an hour for similar World War I vehicles.

Automotic breech mechonism is unique feoture of strotosphere gun.

New Anti-Aircraft Cannon with 11-Mile Range Is Produced in Volume By Automotive Company

GIANT CANNON, capable of reaching eleven miles into the stratosphere to bring down enemy aircraft, are the latest and largest of a long line of guns to be produced in quantity by the automotive industry. These weapons—many of them complex automatic machines composed of hundreds of high-precision parts—have been made on assembly lines not unlike those formerly devoted to the production of motor vehicles and their parts.

The stratosphere cannon is a powerful 120 mm. weapon which, though designed primarily by the Army as an anti-aircraft gun, actually serves a dual purpose because it can be quickly depressed for use against ground targets. Weighing 60,000 pounds, the gun is the heaviest anti-aircraft piece in service, although it is completely mobile and may be transported on its own bogies at a rapid rate.

As early as 1937, the Army became interested in the automotive industry as a source of mass-produced firepower, and plans for limited production of guns were initiated. On March 27, 1941, the first weapon—a .30 caliber machine gun—was delivered to the armed forces. Since then the industry has manufactured and delivered thousands of weapons ranging in size from carbines to the new 120 mm. guns.

Before volume production on this big cannon could be attained, automotive engineers had to adapt the gun to the industry's progressive assembly system. Production men—starting from scratch—designed new tools, jigs and fixtures, machinery and other manufacturing equipment, and the plant was especially laid out to accommodate these new facilities.

Reports from battle areas show the new weapon to be the deadliest of its type ever built. Among the unique features contributing to the cannon's effectiveness is a special breech-loading mechanism—designed by the automotive company's engineers—which operates automatically.

Under combat conditions the gun crew places the ammunition on a loading tray (shown in photograph). The fuse on the projectile is then set by an automatic fuse setter and the shell is rammed into the breech mechanically.

The ammunition used in the stratosphere cannon is of the semi-fixed or two-piece type with the powder charge packed in a separate brass casing.

Trained Ferrets Fight Saboteurs in War Plant

Automotive Firm Freed Of Destructive Rodents

THE TALENTS of five trained ferrets, animals once notorious as the rabbit-hunter's relentless companions, have been successfully employed by an automotive company to rid its premises of destructive rats and mice. Company records show that by destroying an average of from 40 to 50 rodents each week, the rat-hunting quintet has helped to improve morale among women workers.

A major manufacturer of military vehicles, the company found that rats and mice severely damaged large quantities of valuable wood, paper, textiles and similar materials essential to their production. In addition, it was learned that some of the illnesses which caused employes to lose time from work were attributable to the presence of the rodents.

The job of handling and caring for the ferrets was given to the company's Sanitary Patrol, which is also charged with keeping the plant clean. Special cages for the furry creatures have been located in areas where rats and mice are most likely to live, such as in shipping, receiving and storage rooms.

Confined to their cages during the day, the ferrets are released each night to roam the plant, and often they are seen trailing their prey through partitions, under floors and into shipping crates. Each morning the animals return to their cages, where they are fed a diet of bread and milk. As a health measure, the ferrets are bathed twice a week with a solution of mercury and castor oil which repels vermin and acts as a disinfectant.

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Automotive Industry Accelerates War Production

Need for More Weapons in Certain Categories Demonstrated by Invasion of Western Europe

THE invasion of Western Europe demonstrates that the automotive industry's war production job is a long way from completion.

Battle experience since June, when American, British and Canadian troops slogged up the beaches of Normandy, has caused the nation's top military leaders to revise many of their equipment demands, both as to types and quantities.

As a result, the industry has been asked to manufacture new products, or to make design changes in existing products. Most often the request has been for a step-up in the production of weapons in certain categories, where original estimates have been too low.

In one major manufacturing center, during the month immediately following the invasion, approximately twice as many war supply contracts, including renewals, were placed with automotive factories as there were contract cancellations. The new contracts, numbering 153 for war supplies and 271 for facilities, totaled $515,000,000. The valuation placed on the terminated or revised contracts was $228,000,000.

Indicative of how today's battles have altered the industry's war program are these recent military requests:

MORE TANKS—Orders have been received calling for the delivery of one and one-half times as many tanks as were delivered before the invasion. This includes produc-

(Continued on Page 6)

A light passenger car engine helps "The Weasel" climb 45 degree slopes.

Automotive Engineers Develop "The Weasel," New Cargo and Troop Carrier, In 34 Days

OFFICIALLY, the Army calls its newest vehicle the M-29 cargo carrier. But GI Joe, who watched it perform in the Aleutians, Italy and France, took one look and dubbed it "The Weasel."

Low-slung and oblong, with a body longer than it is high, the Weasel is aptly named. It creeps stealthily and swiftly over shifting, powdered snow, through gluey mud or up and down 45-degree inclines.

Developed by automotive engineers in collaboration with the Office of Scientific Research and Development and Army Ordnance, the Weasel made its debut two years ago. At that time the Japs were edging along the Aleutians and the Army had urgent need for a vehicle capable of traversing Arctic glaciers.

The original specifications for such a vehicle were elastic. Save for very definite limitations on weight and size, and some tentatively outlined design and performance demands, the automotive engineers were asked to work out their own solution to the problem —in a hurry and in secrecy.

During this experimental stage, researchers fanned into northern Canada and Alaska, while two scientists journeyed to South America in an exhaustive investigation of snow formations. As the work progressed, parts and even complete vehicles were flown between the automobile factory and the northern ice fields for test purposes.

Within 34 days two vehicles were built and ready for government inspection. One embodied the plans submitted by the Office of Scientific Research and Development. The other was a smaller and lighter model conceived by the automotive engineers. It was powered with a standard light passenger car engine and weighed approximately 1,000 pounds less.

The latter model was the one accepted; a contract was awarded to the company and mass production got under way. Soon there emerged from the factory a steadily growing stream of the odd-looking vehicles.

In appearance and performance the Weasel is a radical vehicle. Its width measurement of 60 inches is more than half its length. Two broad, semi-flexible tank-like tracks extend the full length of a squat, square-cornered body. The ground pressure of those treads, which are extra wide and ribbed for more secure footing in climbing, is about one-fourth that exerted by a fully equipped infantryman.

Operation of the Weasel is fairly simple. Gears are shifted by means of a small lever in front of the driver, while other levers located on either side of the driver control the steering.

Produced on converted passenger car assembly lines, several unusual manufacturing practices were introduced by the company. Starting as a "keel," comprising a number of welded plates and "U"-shaped structural members, the vehicles move along the line progressively receiving steel shields until hull contours are formed.

In another unique assembly operation, the Weasel's four transverse springs are depressed against the underside of the hull. After the progressive installation of axles, engines, drive shafts, wheels and tracks, spring tension is released. This allows the bogie wheels to drop and take up slack in the continuous circuit tracks.

Although designed primarily as a cargo vehicle for use in snow-covered areas, the Weasel has since proved itself capable of performing a variety of jobs over virtually every type of terrain—from swamps to deep sand. To date the Weasel has been used for reconnaissance missions, as a troop carrier, a light truck and a tow car for ambulance and supply trailers in combat zones.

Motor Industry Leads In War Bond Purchases

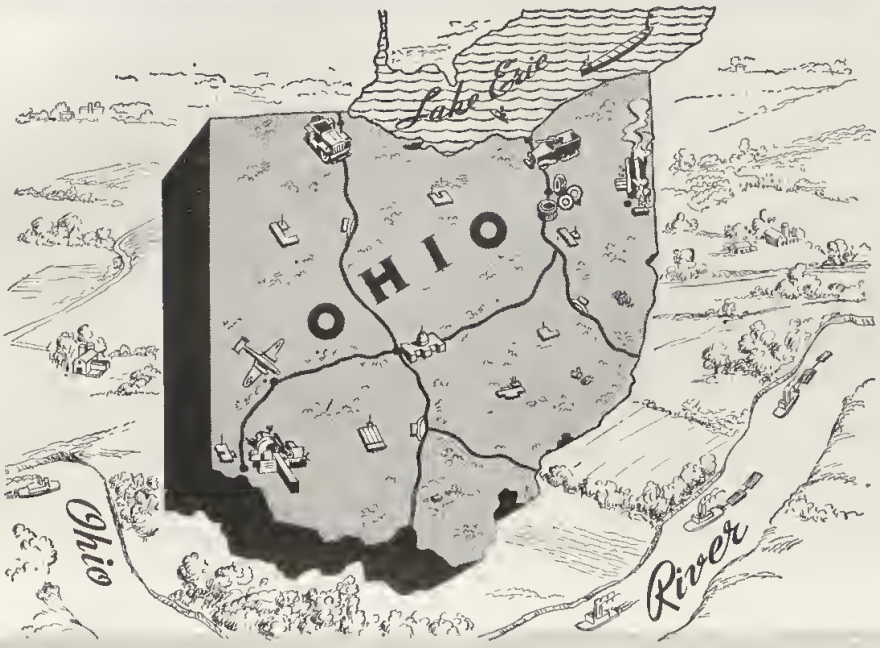
NOT ONLY is the automotive industry the number one producer of war materials used in the invasions of Europe and the Jap-held Pacific Islands, but its employes are also the leading purchasers of war bonds under the payroll savings plan.

Currently, according to a report by the Treasury Department's War Finance Division covering 32 industries, sales of war bonds to automotive workers average 9.5 per cent of the industry's total payroll, well above the national industrial average of 7.3 per cent.

In addition, the Treasury Department analysis points out that more than 85 per cent of all automotive employes are regularly investing in war bonds.

THE AUTOMOTIVE STATES — NO. 2 OF A SERIES

Diversity of Production Stamps Ohio As Major Contributor to The Industry



To Ohio, the woman driver can look with gratitude. The electric self-starter, an invention from that state, doomed the hand crank and allowed women to get behind the steering wheel. Some social historians accord this invention more credit for the liberation of women than any other single factor.

Ohio's inventive sons have contributed much to the automobile, as well as the airplane. Ohio's machine tools have enabled the automobile industry to produce with speed and efficiency in war and peace. Its rubber industry has provided sturdy shoes for vehicles to travel on. Its factories and machine shops have provided a steady flow of parts to automobile plants that cluster in the Great Lakes area.

In peacetime years Ohio took a leading role in the manufacture of motor vehicles, parts and equipment. Prior to Pearl Harbor, durable goods produced for the automotive industry amounted to $285,681,412, with more than 88,500 men and women—equal to the total labor force in such an industrial city as Dayton—drawing their pay from vehicle manufacturers, parts and tire manufacturers and petroleum refiners.

Annual wages paid by Ohio's automotive plants before the war amounted to more than $59,500,000. Currently, with their automotive, steel, machine tool, aircraft and rubber industries producing weapons for the armed forces of the United Nations, Ohioans have seen industrial payrolls soar to new heights.

In addition to those directly connected with automotive manufacturing, many thousands of Ohio's men and women earned their livelihoods in activities built around the automobile industry. Before the war, approximately 242,100 persons drew paychecks from jobs growing out of the sales, service and use of motor vehicles within the state.

Closely allied with this were the 18,975 workers in machine tool shops, a large percentage of whose output went to the automotive industry. When the Buckeye state joins its sister commonwealths in returning to peacetime activities, this automotive background should help provide a solid footing for a sound postwar economy.

The sale of petroleum products and similar commodities provided additional employment for Ohio's men and women. In 1940, the state's 12,800 gasoline filling stations distributed goods valued at more than $168,200,000.

Transportation was an important factor in the state's economic development during peacetime. Ohio has 760 miles of navigable lakes and rivers; major railroads criss-cross the state, with Toledo considered the third largest rail center in the United States. Ohio's 104,925 miles of highways of all types are a valued medium for rapid motor car and truck transportation, linking shipping ports and railroad terminals with manufacturing centers.

The state's highway system, which has been increased by 20 per cent during the past seven years, has been responsible for a sizable share of Ohio's revenue. In 1940 alone more than $97,000,000 in taxes were collected from motorists in Ohio.

Today, Ohio's 101 former automotive factories are completely converted to war production. For example, a Toledo automotive manufacturer, a producer of light motor cars in peacetime, has delivered more than 200,000 jeeps and 2,000,000 shell cases (155 mm.) to the armed forces.

In Cleveland, a former truck manufacturer now makes a wide variety of Army scout cars, half tracks, mobile gun carriages and Army cargo vehicles. Dayton plants turn out carbines for the Army, propellers for the Air Corps, and electrical equipment for all branches of the service.

Akron, largest tire manufacturing center in the world, now builds aircraft, life rafts, special military tires and other equipment. At Springfield, a manufacturer of civilian trucks now produces large quantities of military trucks. In addition, other automotive plants throughout Ohio are manufacturing bulldozers, ammunition, aircraft parts, Diesel engines for the Navy, plexiglass and machine tools.

PEACETIME AUTOMOTIVE JOBS IN THE "BUCKEYE STATE"

Manufacturing	88,657
Federal and State Roads	9,990
Truck Drivers	167,900
Bus Drivers	7,509
Automobile Repair Shops and Storage	7,743
Motor Vehicle and Parts Dealers	23,710
Gasoline Filling Stations	24,435
Automotive Wholesalers	1,813

Small, low-powered vehicles are typical of English automotive production.

WHY YANKS REVERSED THE BLITZKRIEG

H.P. TAX BOUNDS NOT IMPOSED IN U.S.

British, Impressed by American Automotive Industry Output, Make Plans to Study the Origins of its Strength

The American automotive industry produced 55 million vehicles in 15 years.

DURING the Nazi retreat in Italy, Field Marshal Albert Kesselring enumerated reasons for his failure to stem the Allied offensive His report, captured by the American Fifth Army, contained this German excuse.

"The performance of enemy tanks and motor vehicles was astoundingly good"

Thus, from one in a position to know, came corroboration for that observation made by Lieut. General Brehon B Somervell shortly after Pearl Harbor

"When Hitler put his war on wheels he ran it straight down our alley"

Recalling how the efficiency of the motorized German army was viewed with awe only two years ago, and contrasting that with today's situation, Major General C M Barnes, chief of the Ordnance Department's Technical Division, recently said

"Hitler's blitz weapons, with which he overran Europe, were designed and produced in the 1920's and 1930's Most of our Ordnance weapons were designed and placed in production in 1939 or later The differences between our weapons and those of our foes, consequently, are comparable to the differences between a 1940 and a 1930 automobile"

But, General Barnes pointed out the advantage afforded Americans by the quality of their weapons is due to much more than a mere difference in the time of their design and production.

"German manufacturers," he said "were so hemmed in by tariffs that their peacetime markets were too limited for thorough application of mass-production principles. Their factories filled great depots with ordnance that was as modern as any before the war, but much of that equipment now appears obsolescent when placed alongside our further-developed ordnance"

The British, who have derived such a large measure of their wartime strength from America's mass-production facilities, are especially aware that American leadership in motor vehicle production stems from something more than mere physical advantages With more and more frequency of late, British publications have called attention to the obstacles which bar the way to attainment of what the English call "volume" and Americans call "mass" production. One of the latest of many such examples of national self-appraisal, is an editorial in England's *Manchester Guardian*

Explaining that one of England's main "targets for tomorrow" is a greatly expanded export market abroad, the newspaper says "Our war experience has proved that the British motor industry has the capacity, and the skill, to step in and provide us with exportable commodities on a scale hardly equalled by any other industry.

"There are, however, two major conditions which must be realized, and the time for such realization is getting short The first is a reform of motor taxation . . . The second condition, and one hardly less important, is a reduction of production costs."

The first condition referred to is one whose prevalence in all European nations has been most often blamed for the fact that Germany, France, Austria, Italy and England, though all at one time or another in the vanguard of automotive development, lost their earlier advantages to the United States It was to that condition that a French automotive engineer referred a few years before the beginning of the present war, when he commented

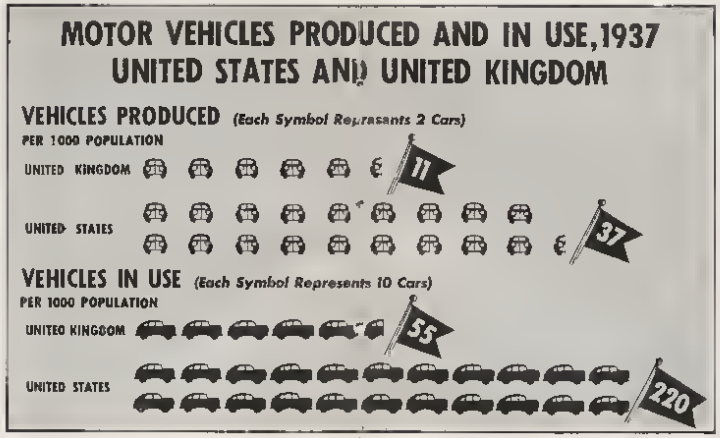
"In Europe the head of every automobile company's designing department is the tax collector"

In 1819, John Marshall, Chief Justice of the United States Supreme Court, warned Americans "The power to tax is the power to destroy"

The European nations generally ignored that truism in adjusting their economies to that new tool, the motor vehicle The result is strikingly demonstrated by comparison of the American automotive industry with that of Great Britain. Though both nations were capitalist in form and nominally in favor of free competition, there was, at bottom, a difference in basic concept.

In the United States, the automobile was early recognized as a necessity to daily living, and was therefore allowed to develop into a mass production instrument, with no prohibitive or warping impediments of taxation.

In Great Britain, it was from the outset considered a luxury item, and was therefore subjected to severe and discriminatory taxation British taxes, imposed on the horsepower of a car or the gross unladen weight of a truck, have for many years forced British motor manufacturers to stay within certain narrow size limits



In contrast, taxes on vehicles in the United States were primarily levied as a means of obtaining suitable highways, and were channeled toward facilitating the use of vehicles

"The British motor industry will never be able to satisfy the requirements of the export markets while its designers, technicians, and production engineers have restrictive taxation shackling their abilities," said the *Manchester Guardian* editorial

Searching for the fundamental factors that hobbled the British motor industry in its competition with an American industry that produced 55,500,000 cars and trucks in 15 prewar years, the British are re-examining production costs.

"In prewar years," they observe, "the cost of producing British cars and commercial vehicles was very much higher then it was in America"

Although they grant that "manufacturing costs depend in part on annual volume of production," and that "in America the annual production rate has been about ten times that of this country," they add

"But volume production does not explain the difference between British and American costs"

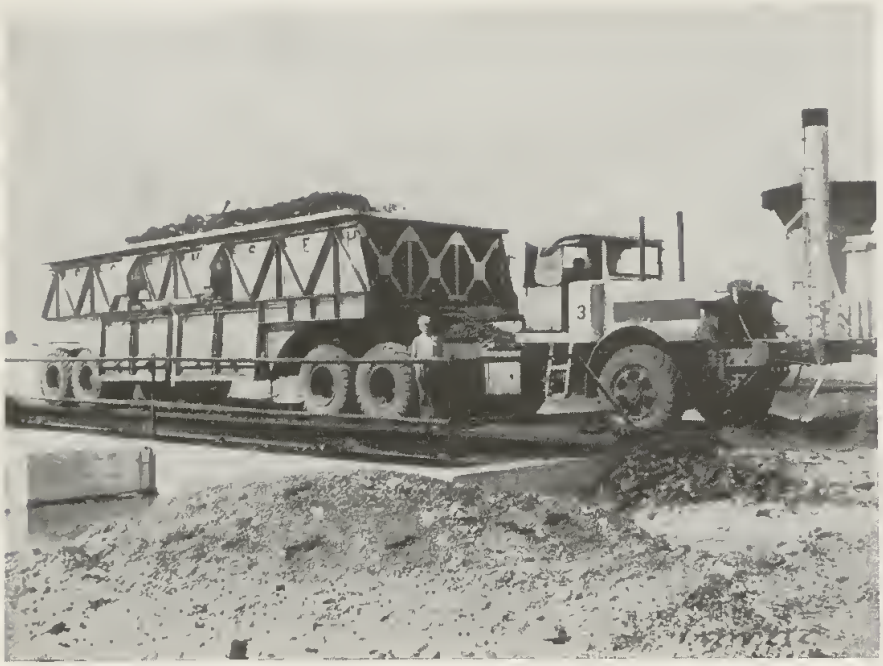
Next they examine the costs of labor, raw materials and fabricated products The British disadvantage, they remark, does not lie in labor costs, since "American labor costs per hour were about twice those of British labor in the immediate prewar years"

Analyzing the materials used in a representative British vehicle and comparing their costs with those of similar American products, they unearthed some significant contrasts. They found that a steering wheel cost the British manufacturer 81 per cent more than his American competitor, a starter cost 79 per cent more, a distributor 59 per cent more, a crankshaft cost 127 per cent more, and malleable iron castings and steel body sheets cost twice what the American car builder paid for the same product

Summing up, this appraisal pointed to the underlying cause of the British weakness in the following words

"It has been stated that 66⅔ per cent (by cost) of the materials, raw and semi-fabricated, purchased by British motor vehicle manufacturers is controlled by rings, combines, and cartels"

In other words, American motor vehicles were able to dominate the world markets in prewar years and become decisive factors in the global war for liberation because they were the product of a free and enterprising people, competing for rewards without either the constraining shackles of cartels or the crippling taxation which is the inevitable consequence of governmental attempts to maintain such artificial limitations on abundance



Giant trucks transported 60 per cent of the nickel ore produced last year.

Automotive Industry Builds 50-Ton Vehicles For Specialized Hauling Jobs on Home Front

GIANT 30- to 50-ton super trucks have been developed by the automotive industry for specialized operations on the home front.

Weighing, when fully loaded, from two to three times as much as a General Sherman tank, these huge vehicles are taking an important part in the nation's war production program by transporting basic raw materials from open-pit metallic mines to refining plants, steamship docks and railroad freight terminals. The trucks cover from three to 160 miles daily.

During 1943, for example, the trucks were credited with transporting an estimated 60 per cent of all the nickel ore produced in the United States.

Among other unique wartime motor truck developments to date is a fleet of 73-foot tractor-trailer combinations designed especially to transport aircraft subassemblies between two war plants 1,300 miles apart. Similarly, large truck-trailer units are being used to haul deck houses for Navy subchasers from fabricating plant to shipbuilding yard. Oversized trailers which carry prefabricated house sections from factory to workers' housing areas in busy war centers, and mobile clothing stores which serve war-worker residents of rural communities are additional adaptations.

The ore-mining trucks are powered by Diesel engines and are built to carry loads which equal their weight. Many of them have been in continuous operation for more than 20,000 hours and have hauled millions of tons of raw ore.

Last year, similar special motor trucks built for coal field operations are reported to have hauled more than 300,000,000 tons of covering earth and coal from open-pit mines. This year's fuel production goals indicate that mine-operation trucks will establish a new record by transporting a total of over 400,000,000 tons of coal.

Under actual operating conditions, a single 30-ton truck is able to transport 3,000 tons of ore or coal on a short-haul basis every 24 hours, a volume equal to that carried in sixty average railroad gondola cars. At one coal mine, for example, records show that six of the largest type motor trucks consistently transport 9,000 tons of coal in a seven-hour day over a three-mile route, a haul equal to that carried in 180 average rail car loads.

Production Stepped Up In Automotive Plants

(Continued from page 1)

tion of new tanks, and refitting vehicles, once used for training purposes, for combat.

MORE SHELLS—Production of shells for the famous "Long-Toms" (155 mm.) has been tremendously increased since the drive for Germany got under way.

MORE TRUCKS—Lieut. General Brehon B. Somervell recently said: "Our guns will be pulled and the supplies and troops will move into Berlin and Tokyo by truck." Recently, top priority was accorded the manufacture of vehicles in the heavy category, as the armed forces called upon the industry to virtually double its production of military trucks.

MORE AIRCRAFT ENGINES—Several plants are now in the process of converting from production of one type bomber engine to production of a larger type to help meet the new goals. Another company is rapidly increasing its delivery of power plants for B-29 super-fortresses. Other automotive manufacturers are swinging into production on more powerful fighter plane engines.

At the same time the manufacture of other essential military items is being held in line with current military demands. On July 31, the value of all war goods produced by the automotive industry since the start of the national re-armament program in September, 1939, passed the twenty-billion-dollar mark. This huge sum is equal to the 1940 valuation of all farm land, farm buildings and farm equipment west of the Mississippi River.

AUTOMOTIVE WAR PRODUCTION

Published by

WAR PRODUCTION INFORMATION DEPARTMENT

Automotive Council for War Production

GEORGE H. CUSHING, Editor

New Center Building, Detroit 2, Michigan

WAR ON WHEELS

IN A recent address before the SAE War Engineering Board, Major General Charles T. Harris, Jr., commanding officer of the Army's Aberdeen Proving Ground, remarked: "I can say without the slightest fear of contradiction that if it had not been for the automotive industry the Allied Nations by this time would have lost this war on every single front."

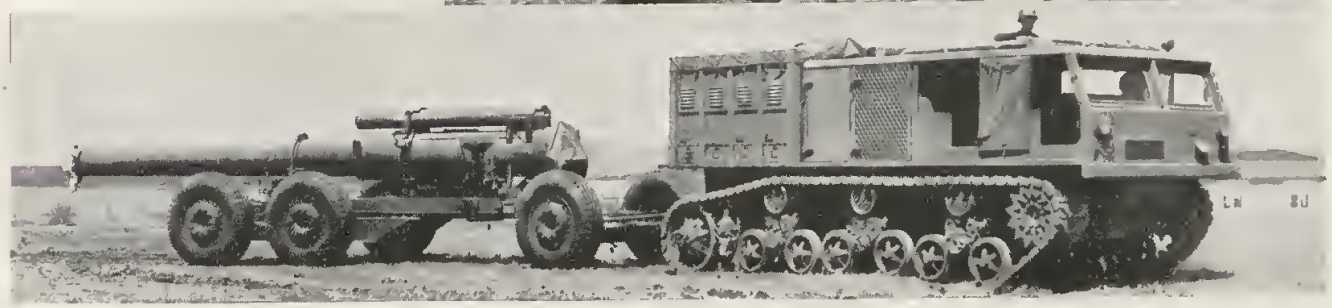
As an indication of the size of the industry's military vehicles program, automotive plants are currently manufacturing 226 *different* types of trucks. To date, the industry has delivered more than two million of these vehicles to the armed forces as compared with 90,000 in World War I.

ABOVE: Bamb trailers are ane af the many types af vehicles used by the Army and Navy air farces. Here, as in countless Americon air bases, high explosive missiles are towed to dive bambers by special trucks.

BELOW: In the jungles af Baugainville, mabile machine shaps accomponied the fighting Marines inta the frant lines. These speciolly designed mabile units were equipped ta fix anything fram a rifle ta a six-tan truck.

ABOVE: Bulldazers, which generally mave inta a hostile pasition with the first wave of attacking traops, are impartont weapons. They have hacked raads thraugh Burmo, the mountains of Italy, and Narmandy's flaaded fields.

BOTTOM: Here is the 38-tan prime mover, largest vehicle of its type in the United Stotes Army. Designed ta pull the 240 mm. howitzer into combat pasitian, the tank-like treads enable it ta traverse the roughest terrain.



Majority of automotive executives started on the bottom rung of the job ladder.

Door to Advancement in Automotive Plants Always Open, Employment Statistics Reveal

As HOPES for an early and victorious end of the war brighten, the nation's fighting men turn naturally toward the future and the opportunities which that future may offer to those who fought for it.

For such men, the history of the automotive industry provides a potent antidote for the fallacious theory that, "since the last American frontier had been settled, all the fertile fields of opportunity were now fenced off."

In this industry the axiom, "There's always room at the top" has as much factual foundation today as it had in that recent past when, to cite three famous examples, an immigrant shipyard laborer, a roving railway machinist and an orphaned boy bound out to a farmer could each rise to presidency of large manufacturing firms.

Today, in one company alone, 65 of the 93 highest managerial posts are held by men who originally started in jobs at the bottom of the ladder. With 69 per cent of its top executive positions filled by personnel drawn from its own ranks, and the rest having come up "the hard way" in other organizations, this company is typical rather than exceptional.

Of 21 posts currently classified as plant or division managerships, 17 are occupied by people who began work with the company in such classifications as stock chaser, time clerk, body trimmer, salesman and so forth.

Among 29 at the superintendent level, 19 began as either tool crib clerks, cost clerks, press repairmen, assemblers or die shop workers.

Of 43 on the general superintendent level, 29 take pride in the distinction, "old hand," and trace their company records back to beginnings such as welder, press operator, metal finisher, and purchasing department clerk.

From the inception of the automotive industry at the turn of the century, men with ability and initiative have always been able to advance to more responsible positions fairly rapidly. A young and vigorous industry, its phenomenal growth presented a constantly expanding demand for leaders.

The fulfillment of that demand produced factual sagas that dwarf the imaginings of the Horatio Alger type of fiction. Almost familiar enough to be classed as American folklore are the life stories of the two Danish immigrants who rose from the ranks of common laborers to positions of great power in the industry.

Familiar, too, is the tale of the roving railroad worker whose family and friends doubted his sanity when he plunged deeply in debt to buy a $5,000 car just to master its mechanical principles, but who went on from there, via a succession of jobs in motor plants, to eventual organization of a new company that succeeded at a time when all "expert" opinion predicted certain failure for newcomers.

Less known than these, but perhaps even more dramatic, is the saga of the man who, bound out to a farmer as a boy and unable to escape from farm labor until he was 27 and married, nevertheless managed to work his way up from a job as auto-body trimmer to the president's chair of his own company.

For such sagas, to be written tomorrow, the events of today continue to grind out the facts. For anyone with enough curiosity to seek them, the facts are not hard to find, either in the shops and offices of the larger corporations or in those hundreds of little shops which, continually springing up along the back streets and in the outskirts of every automotive manufacturing center, represent the faith of free American workers in their ability to reap the rewards of initiative and enterprise in a land whose horizons are still limitless.

Penicillin Produced In Plant Laboratory

Doctors employed by an automotive company have developed a treatment for troublesome skin infections which reduces the time required for medication by 15 days. The method employs the use of crude penicillin grown in the firm's own hospital laboratory.

The process of obtaining crude penicillin is fairly simple. A pure bread mold culture, secured from the United States Department of Agriculture, is grown under sterile conditions on gauze impregnated with a media prepared from starch, sugar, gelatin and dehydrated brewer's yeast.

When the gauze and semi-solid media become saturated with the crude drug, it is ready for use. The mold is then removed and the gauze cut and bound over the open surface of an infected area. Because the properties in crude penicillin differ from those in pure penicillin, the former cannot be refined and used intravenously.

AUTOMOTIVE
WAR PRODUCTION

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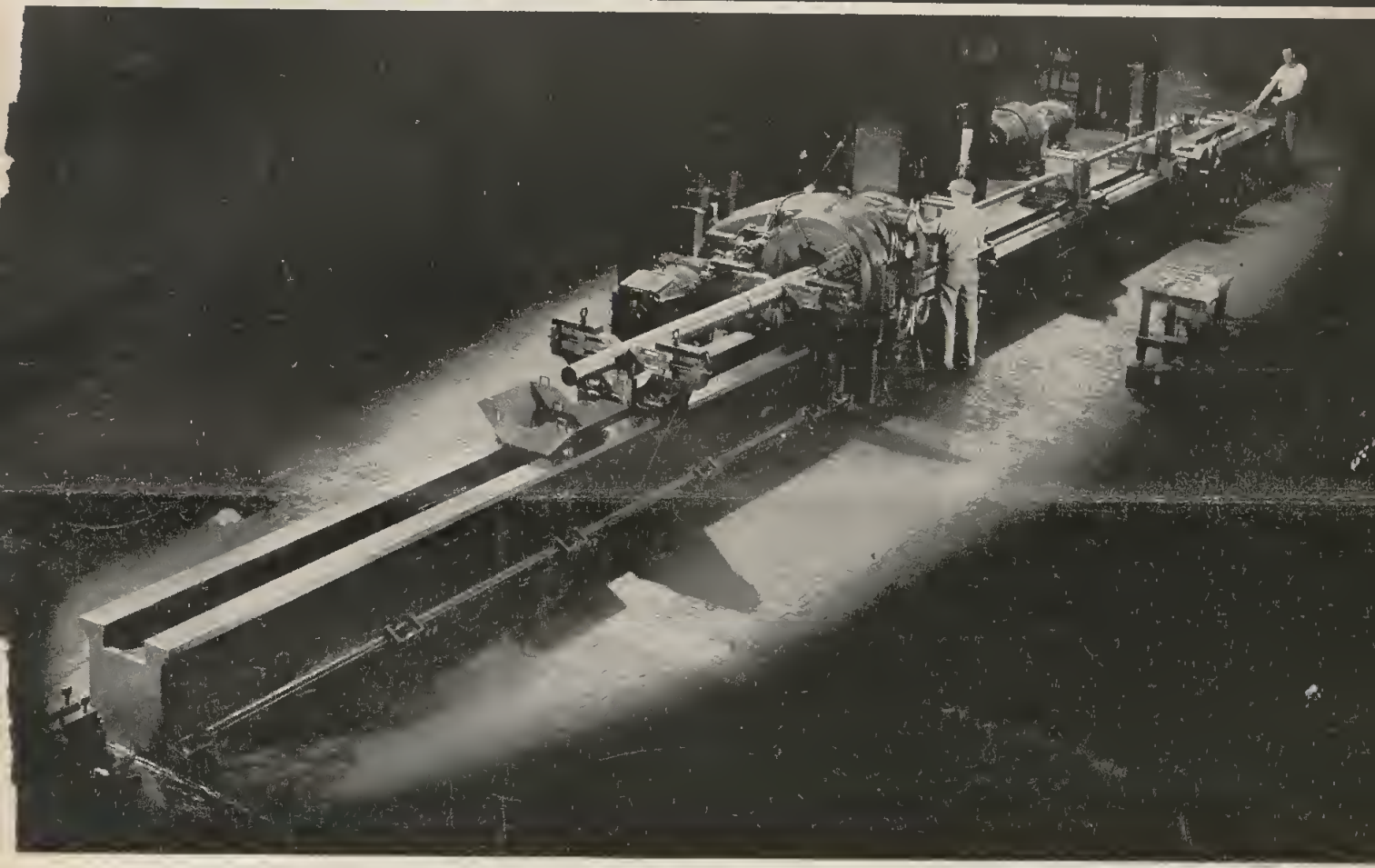


Special Tools Make Volume Production Possible

Automotive Industry Sees Limited Application Of This Equipment To Peacetime Manufacturing

THE defeats suffered by American arms in 1941 at Pearl Harbor, Guam and the Philippines spawned a phrase that no adult American is likely to forget during his lifetime—"too little and too late." It was freely and widely interpreted to mean that our fighting men simply had too few weapons and the wrong kind of weapons to meet the enemy on even terms.

Not nearly as well appreciated was the truth that these weapons didn't exist because the precision machinery required to make them didn't exist either. Even after a long uninterrupted string of victories in Africa, Europe and the Pacific it is difficult to grasp the direct connection between a high speed automatic screw machine in a midwestern arms plant and a machine gun platoon entrenched in a palmetto clump on the island of Saipan.

That connection between machine tool and machine gun is direct and unescapable. It is part of the unseen background behind the automotive industry's $1,000,000-an-hour war production rate.

Mass production in volume means proper tooling. But even though about 75 per cent of the industry's peacetime tools were converted to war production, the war products were so radically different from cars and trucks, and the need for these weapons was so great that thousands of additional tools were required—special tools, designed specifically to machine tank parts, to extrude aluminum for airplanes, to draw out slabs of metal into long cartridge cases.

(Continued on Page 6)

Civilian and military carga trucks are assembled simultaneously by one company.

Army Trucks and Civilian Vehicles Produced On Same Assembly Line To Meet Wartime Needs

IN 1940 there were two great motorized movements in the world. One received wide-spread public recognition; the other, though little noticed, was the forerunner of still greater news to come.

In the spring of that year, Nazi panzer divisions swept through France and the Low Countries, astounding the world with the speed of their advances, and the headlines recorded the events with awe and misgiving.

Simultaneously, but with slight recognition, huge fleets of cargo carriers were doing a routine job of freight hauling across the length and breadth of the North American continent, traversing roads of every type and ploughing through every vagary of wind and weather.

Born to peaceful purpose rather than military design, these American-made trucks were even then the potential backbone of a motorized military power that would one day sweep the Nazis from Africa, Italy, Russia and France. Perfected in the hard school of commercial competition which accepts only the best, they were actually superior to Hitler's—although few persons then realized it.

Now, these vehicles form the backbone of the Allies' swift-moving European military machines. They are the principal means by which the food, gasoline, ammunition, medical supplies, clothing, guns and other combat equipment is moved rapidly from transport ships to battle zones.

As fought today, war is basically a battle of supply lines. Modern armies are far more dependent on highly organized transport systems than military units of any previous period.

Formerly, troops carried with them enough ammunition to supply slow-firing rifles and fieldpieces for many hours. Today, with one machine gun requiring 100 pounds of ammunition for two or three minutes of steady firing, a 75 mm. gun using up 375 pounds of ammunition every minute, and a single infantry rifle company consuming 500 pounds of ammunition in one minute of rapid firing, motorized supply is imperative.

When America entered the war, military leaders began searching at once for motorized equipment capable of meeting and beating the enemy; and for productive capacity to make that equipment in quantity. Their search was short and quickly satisfied in the motor truck field. Here, manufacturers, who had vied with one another in competition for 25 years, had developed the world's most powerful truck types; and had seen their vehicles proved over the ugliest terrains and in the worst climates.

One typical company was producing 35 models ranging from one to ten tons in size, and powered by an engine of extremely high horsepower-to-weight ratio. After contracting to produce six- and ten-ton cargo trucks and prime movers, as well as develop scout cars and half-tracks, it was found that the basic engine and chassis which had hauled freight throughout the nation required few changes for adaptation to military uses.

Conversion of the company's 2,000,000 square feet of production space was accomplished gradually over a period of several months, but production quickly jumped to two and a half times the peacetime rate, although no additional plant facilities were added. To meet the increased output, employment rose from 1,900 to 5,600.

Meanwhile, to keep the wheels turning on the home front a limited number of commercial trucks was needed. The company found that the production problems connected with building its own heavy-duty vehicles were so similar to those connected with the building of the Army's models that the two could be manufactured simultaneously on the same assembly lines.

The extraordinary sight of military and civilian cargo trucks following one another off the same assembly lines would astound the Axis people for they were forced to choose "guns instead of butter" and to sacrifice everything for war production, under a system that stifled enterprise through government control.

Combat Vehicles Employ New Type Brake Lining

IF BATTLE experience is any criterion, the nuisance of smoking brakes will be eliminated from the nation's post-war automobiles. A revolutionary new asbestos and synthetic resin brake lining, developed by an automotive company just prior to the war and until now used exclusively by the armed forces, promises to do the trick.

Proved on nearly a million jeeps in combat areas throughout the world, the new lining is the result of four years of research and development, costing the automotive company $925,000. To date, 61 war manufacturers use the lining, while more than 20 million pieces have been produced by the company for Army and Navy vehicles.

THE AUTOMOTIVE STATES — NO. 3 OF A SERIES

Motor Vehicles Play Important Role In Wisconsin's Peacetime Economy

To a blacksmith in a small Wisconsin city, the American people owe a debt of long standing.

For it was in the town of Clintonville prior to World War I that Otto Zachow perfected the principles of the four-wheel drive — principles responsible for the sensational performances of American trucks and combat vehicles in two world conflicts.

Wisconsin is also a state famed for dairy products and year-round vacation facilities.

Its well-kept, prosperous farms produce a large share of the nation's cheese, condensed milk and casein products. In peacetime, its thousands of lakes and resorts provided rest and recreation for tourists from all parts of the country.

Not so generally known, however, are Wisconsin's contributions as a manufacturing state which, before the war, delivered industrial products valued at over a billion dollars annually.

In automotive manufacture, Wisconsin played a major role in the production of motor vehicles, parts and equipment prior to Pearl Harbor. Durable goods supplied the automotive industry amounted to $162,080,952 annually, or slightly over 10 per cent of the state's industrial total.

Similarly, approximately 10 per cent of all industrial wages received by men and women in the "Badger State" were paid by automotive plants. As the result of jobs with motor vehicle and parts manufacturers, the state's 16,963 automotive employes took home pay checks aggregating $28,853,417 annually.

Today, Wisconsin's factories and farms are devoted to producing weapons and foodstuffs for Victory. Typifying the variety of the State's war production are these examples: Ships for the Navy from yards in Manitowoc; shells from the plant of a former automotive assembly plant in Janesville; military trucks, bulldozers and prime movers from plants in Milwaukee; aircraft engines from an automotive assembly plant in Kenosha; and military vehicles from Clintonville.

Yet when peace comes again, Wisconsin's prewar automotive activity should help provide a strong basis for the state's continued economic progress. For, in addition to those employed in automobile and parts manufacturing in 1939, approximately 122,323 Wisconsin men and women earned their livelihood in jobs connected with tire manufacturing, petroleum refining, sales, service and use of motor vehicles.

An important source of income for Wisconsin folks is the gasoline filling station. In the year before the war, workers in the state's 5,942 outlets sold $74,175,000 worth of petroleum products and other commodities.

The sale and use of motor vehicles in Wisconsin, annually made up an important part of the state's revenue during the peacetime years. In 1940, for example, motorists paid $35,917,000 in state taxes.

One of the nation's leading agricultural states, Wisconsin farmers depend heavily on motor vehicles to speed their produce to market. (Nearly a third of all its citizens earn a living from the soil, a percentage well above the national average.) The latest peacetime figures show that Wisconsin farmers owned 213,195 passenger cars or trucks, a ratio of about one vehicle to every farm family of four.

As a noted vacation area, Wisconsin's highways have taken an important part in the development of scenic and resort regions. In a recent five-year period, nearly 9,000 miles of surfaced roads of all types were added to the state's system, making the renowned lake areas even more accessible to tourists throughout the middle west.

When civilian production is resumed, the ability of Wisconsin's 49 automotive companies—as well as its other manufacturing facilities — to provide employment quickly may well depend upon the speed with which plant space can be cleared of government-owned surplus materials following the wholesale termination of war contracts.

Automotive Employment In the "Badger State"

Manufacturing	16,963
Federal and State Roads	4,187
Truck Drivers	85,600
Bus Drivers	2,325
Automobile Repair Shops and Storage	3,051
Motor Vehicle and Parts Dealers	10,429
Gasoline Filling Stations	10,748
Automotive Wholesalers	1,200
Tire Manufacturing and Petroleum Refining	4,783

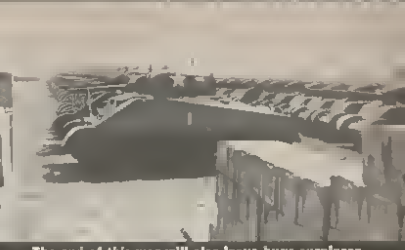
The AFTERMATH OF WAR PRODUCTION

A Study of the Disposal of Surplus War Materials

When World War I production stopped in 1918... war equipment worth millions of dollars was on hand...

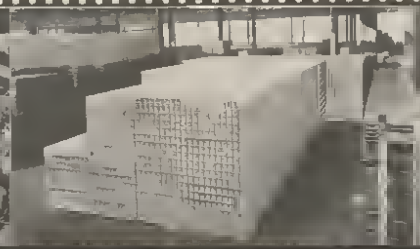
tires, trucks, guns, clothing and dozens of other items.

Retail stores sold some of it, but much was scrapped.



The end of this war will also leave huge surpluses...

war contracts will be quickly cancelled...



products, tools and parts will jam factories.

In a typical cancellation of a tank contract recently...

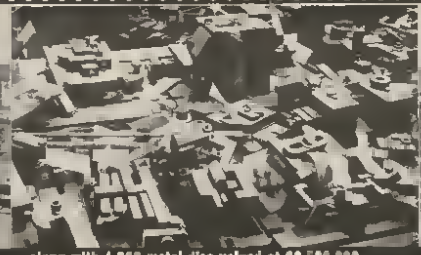
the surplus material and tooling cost was $30,000,000.

$25,000,000 worth of material was unusable as is...

manufactured items costing $30 million were scrapped...

perishable tools worth $5,000,000 were left over...

2,591 special jigs and fixtures remained on hand...



along with 1,268 metal dies valued at $2,500,000.

Surpluses occupied acres of outdoor storage yards...

and much valuable factory production space.

Quick, efficient disposal of surpluses is necessary...

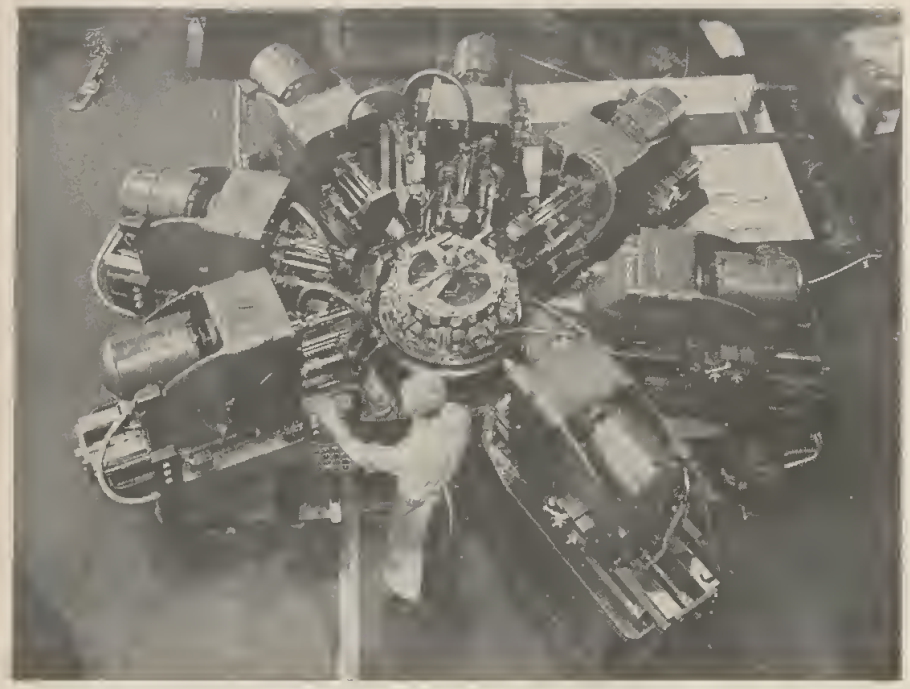
to free plant facilities for peacetime production...

to avoid industrial stagnation and unemployment.

• • • • • *Scenes from a 17-minute sound motion picture produced by the Automotive Council for War Production.*

THE END

16mm prints are available to luncheon clubs, schools, farm and civic groups without charge upon request to the Council.



One especially-built tool performs 147 operations on an aircraft engine part.

Industry Sees Limited Uses for Special Tools

(Continued from Page 1)

Long lines of these special machines, shaping, forming, curving and cutting many kinds of metals, represent the missing link between today's victories and yesterday's defeats. Because huge boring mills were built and set up for mass tank production, the Axis tide was stopped at El Alamein by American and British armor. Because tremendous aluminum extruders were set up to feed the aircraft assembly lines, the Luftwaffe was driven from the skies and the time became ripe for invasion.

Yet, these specialized tools so vital to victory take on a different aspect when viewed against the postwar era. About 10 per cent of the special war production tools made for the automotive industry have no foreseeable peacetime use. Converting them would be prohibitively expensive, and their cost of operation would be disproportionately large after they were converted, because they were made to handle beavier metals in larger quantities than peactime goods would call for.

Consider for example a 3,300-ton rod extrusion press, made to handle aluminum for aircraft production. The complete installation of such a press costs $250,000, and because of its size, six freight cars would be required to transport it from one location to another. Throughout the war, it labored faithfully on millions of pounds of aircraft aluminum, but after the war there may be no demand for its capacity.

Or, what of the huge vertical boring mills especially designed to speed tank manufacture? Weighing 112,000 pounds, and costing $49,500 each, these mills can handle an armored tank turret with ease, but in peacetime there will be no immediate need for their sinews.

Again, what of the complicated machine which drills, reams, countersinks and mills the trigger housing of the Garand rifle? Its cutters work simultaneously from six different directions, and this one machine alone does in 58 seconds the work which it formerly required four general purpose machines each 11 minutes to perform—an increase in productivity of 4,400 per cent.

Special purpose machines, like people, fall into special types. Some are speed specialists, some are adept at complicated operations, and others are designed for extraordinarily heavy-duty operations.

The speed specialists, while possibly adaptable to peacetime operations, have a rate of production far beyond what the normal consumer market would absorb. The automatic screw machine which cuts .50 caliber armor-piercing bullets from tough tungsten-alloy steel can produce 10,000 bullets in 24 hours. Yet, it must operate *sixty* hours without a stop to keep one machine gun firing one hour. In peacetime, even if converted, there would be no foreseeable demand for such a quantity of the small products it turns out.

The same thing can be said of the mighty automatic transfer processing machine which is used to mill, drill, bore, ream, tap and chamfer aluminum aircraft engine cylinder heads. This machine, 180 feet long, and weighing 584,000 pounds, produces 213 different operations on sixty different cylinder heads per hour. A marvel of mechanical ingenuity, its cost is $650,300, including fixtures and electrical equipment, but it does the work of 39 separate machines, and saves half an hour on the machining of every completed part.

Many hundreds of machine tools like these are in automotive war production, and their daily output of war goods makes up a large part of the mass of materiel which is giving the Allied armies ascendance on every front. Their cost of construction and operation is part of the price of victory in war, and their proper disposal bids well to be of major importance in the over-all problem of reconversion.

In Tunisia, Sicily, Normandy and the Pacific, the fighting men had the weapons, in quantity and quality, to win decisively. The work of special machines such as these did much to wipe out the disgraceful phrase so often quoted in 1941.

To avoid having them interfere with reconversion, however, a true and realistic appraisal of their worth to the nation's economy must be made, not in terms of their cost, because that cost is part of the price of victory, but rather in terms of what they can contribute efficiently to the postwar production volume of the industry.

AUTOMOTIVE WAR PRODUCTION

Published by

WAR PRODUCTION INFORMATION DEPARTMENT

Automotive Council for War Production

GEORGE H. CUSHING, Editor

New Center Building, Detroit 2, Michigan

This cartridge plant became a tank repair center in less than a month.

Automotive Company Converts Cartridge Plant To a Center Where 30-Ton Tanks are Repaired

BEFORE a single civilian product—such as a radio, a refrigerator or a passenger car—can be offered to the nation following V-Day, American industry must convert its manufacturing facilities from a wartime to a peacetime footing.

While the speed with which plant space can be cleared of government-owned machinery and materials will determine the time lag between the cessation of war production and the resumption of consumer-goods production, the actual physical aspects of conversion are familiar to automotive men.

In peacetime, automotive plants were annually converted from the manufacture of one model to another. Since Pearl Harbor, the constantly changing requirements of war have dictated uncounted minor and major conversion jobs to the industry.

Recently, for example, an automotive company took less than a month to convert one of its large plants from the manufacture of small arms ammunition to a repair center which overhauls and modernizes giant General Sherman tanks for combat purposes. In comparison, the cartridges—for .30 and .45 caliber weapons—weigh seven-tenths of an ounce and are worth two and a half cents apiece while the tanks weigh 30 tons and are valued at approximately $40,000 apiece.

During a discussion of the problems met and overcome in the conversion job, a company executive labeled it "a sort of an ant to elephant task."

Within a week after the company received its tank assignment late in June, the first shipment of vehicles arrived. They came from Army training camps, and the job was to fit them for front-line fighting—part of the national program to increase tank deliveries by one and a half times over the requirements preceding D-Day.

In the interim, some 2,000 cartridge-producing machines and other equipment, which in 22 months had turned out more than 3,000,000,000 rounds of ammunition, were being ripped out of the plant's interior and prepared for shipping to other ammunition-producing factories. An estimated 400,000 square feet of space was being cleared and readied for the heavier tank rebuilding equipment. Workers and welders were being trained in the special skills required for the job.

Modification parts to bring the tanks up to date started rolling into the plant within three weeks, and thereafter arrived on a daily schedule. To handle these heavy parts and to hoist them into place, large temporary A-frames were located throughout the plant, while most overhead and surface structures had to be reinforced to accommodate a product weighing 1,400,000 times as much as each cartridge.

Today, approximately two and a half months after the tank contract was received by the company, production rates indicate that 1,000 of the vehicles will be delivered to the armed forces by the end of this year, with a second thousand being placed in Army hands by spring.

Survey Shows Increase In Passenger Car Age

ALTHOUGH handicapped by a wartime decrease in maintenance facilities and a scarcity of replacement parts, the American automobile is being kept in service by its owner for greatly increased periods of time, a recent U. S. Government survey shows.

Before the war the average life span of a passenger car, between the factory gate and the junk-heap, was 5.8 years. By the end of 1944, with transportation facilities at a premium and prospects for new automobiles not yet in the immediate future, the average age of passenger cars on the nation's highways will be close to 7.2 years.

Since Pearl Harbor, the nation's pool of 29,500,000 registered passenger cars has been reduced to about 25,000,000, with vehicles leaving the road at an estimated average rate of 2,500 a day during 1944.

These findings, pointing up the stake the American public has in speedy postwar reconversion of automobile plants from a transportation standpoint alone, come from the Public Roads Administration which sampled 1,134,093 rural and urban car owners in 23 states and the District of Columbia.

The survey was broken into eleven major occupational groups, ranging from "personal service" to "industrial workers" and "farmers." Automobiles with the highest average ages were owned by the "unskilled laborer" and "farmer" occupational groups, with 8.1 and 7.4 years respectively.

High school and college teachers receive expert instruction on a grinder.

Something New In Education Has Been Added; Automotive Industry Teaches the Teachers!

WORLD WAR II, which introduced advanced, intensive educational techniques to millions in the armed forces, has brought about new trends in education on the home front also.

Virtually all major automotive firms, for example, have participated in training Army and Navy personnel for the wide variety of tasks requiring special skills which motorization of warfare has created. By means of motion picture and slide films, lectures, classroom study and shop work, many thousands of persons have received training in the industry's school since the beginning of the war. Recently, one of these schools, opened in 1941 for training of Navy personnel, graduated its 20,000th student.

In most cases these facilities were made available to the nation by adapting and expanding the automotive companies' existing training programs to meet the emergency needs of war. For this task, the industry was well prepared. Its company-operated schools, some of which have been in existence for almost a quarter of a century, had continued to function right through the depression years, when there was a marked decline in most industries' apprentice training programs.

One result of the wartime expansion of this industrial activity has been that educators themselves have taken notice of it.

Two years ago, one of the automotive companies' school directors inaugurated a two-months' course for vocational guidance counselors in high schools and universities, with the thought that actual shop experience would aid them in their work. About 70 teachers, taking postgraduate courses in Michigan, Northwestern, Wayne and Cincinnati Universities, attended.

This year, a second company offered a similar course, with the cooperation of four universities; and a total of 130 teachers from 15 states attended the two courses.

In general, the policies of the two schools toward the teachers' courses are the same. Each provides 40 hours of actual work on machines per week. Since many types of machines are available, the students work on from 10 to 26 kinds during a course, with the average about 15. Also, each student works with as many kinds of metal as possible.

These student-teachers learn how work is done by actually doing work—a method which a famous dean of a divinity school in one of the nation's oldest universities recommended to his students some years ago, and for which one automotive company supplied the facilities whereby 50 divinity students annually got first-hand knowledge of workers' problems through summer-time work in the shops.

One of the schools, for example, actually turns out war products—parts for bombers, tanks, trucks and guns—for which it bids against regular production departments. Its work must therefore compete in cost and pass standard inspection. The other school produces precision tools, which are used throughout the plant.

In addition, students in both schools are required to take from four to eight hours a week of classroom instruction, given by the companies' training officials, and by instructors from the cooperating universities. Subjects range from general company policies through topics concerning mass production to employe relations and merchandising methods.

Each school pays its teacher-students approximately $1 an hour for time in shop and classroom alike, with time and one-half after 40 hours weekly. Furthermore, the cooperating schools accord a credit of four hours toward a degree in postgraduate work.

The teachers themselves are enthusiastic. Typical is the response of one woman, a mathematics instructor and vocational counselor from Iowa, who said:

"I know that since taking the course I shall be infinitely better qualified to give advice to students who are interested in shop work. The importance of guiding mechanically apt students into shops cannot be over estimated."

Another, a psychologist on the staff of a large city's board of education, said:

"The background I have received from this training is invaluable. I can appreciate now what a boy who wants to be a good mechanic has to learn."

Most common, however, were observations which indicated that the student-teachers have acquired higher regard for the dignity of productive work. Expressed variously, this was aptly put by one who said he had discarded his former opinion that "factory workers lost their names and became merely numbers."

Both firms are planning expansions of these programs next year, and it is also possible that this novel trend in education may spread to other automotive companies and to other industries.

AUTOMOTIVE WAR PRODUCTION

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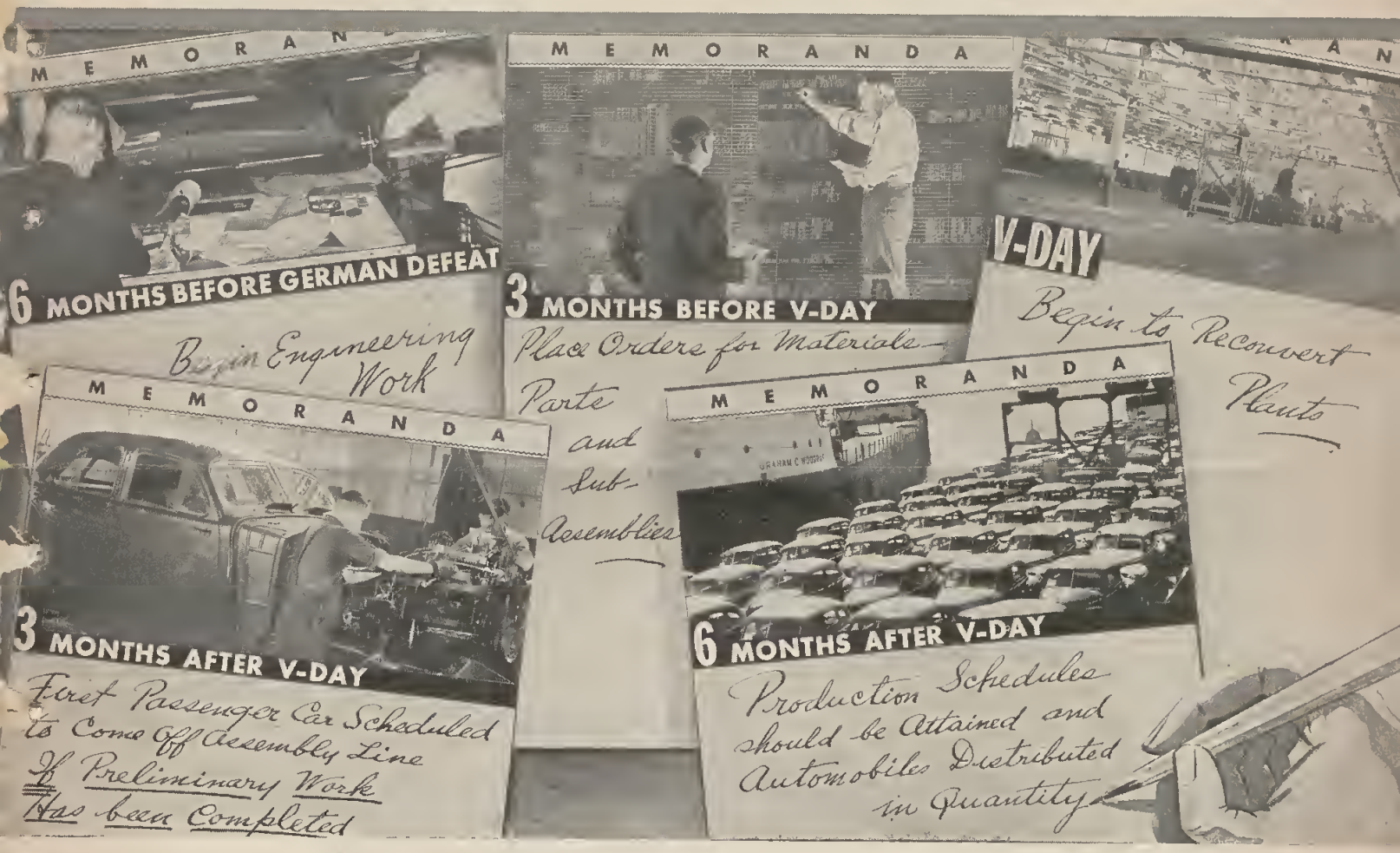


Time Factor Governs Automotive Reconversion

Plants Put War Work First, but Make Plans To Bridge Gap to Passenger Car Production

JUST as a general must have plans ready to meet changing conditions in the field, so an industrial executive must be prepared with blueprints to meet unexpected shifts in the production picture.

To fill military demands, the automotive industry currently is pressing its war production program forward at a *ten billion dollar a year* rate, with no let-up in sight.

Yet, like the general whose plans must embrace not only the immediate battle but an entire military campaign, industry must devote a portion of its planning to an objective of great national importance—jobs after V-E Day.

For Victory-in-Europe will mean a sudden, drastic curtailment of war production schedules, according to government announcements, and the automotive industry must be prepared to push car production work to help bridge the employment gap.

How much the nation's civilian economy suffers during the Battle of Reconversion will depend, to a considerable degree, upon the length of time the motor industry takes to re-establish its production pattern which was torn asunder, reshuffled and strewn widely in the wartime changeover.

(Continued on Page 2)

Automotive Reconversion Controlled by Time

(Continued from Page 1)

Planning for car production revolves around the time it takes each of several thousand components to move from the earth through the long, involved progression of refining steps, through furnaces and mills, foundries and forges, and the myriads of machines and tools that cut, twist, bend or shape hard physical objects into desired forms.

The lack of machinery for essential manufacturing operations can block this flow from mine to consumer, and deprive men of jobs all along the route.

One automobile company estimates that it needs 3,600 new machine tools, as replacements for tools lost at the time of conversion, in order to resume car production at the rate of 50% of its 1941 schedules.

Since it takes months to design and build such machines (16-20 weeks for a drill press, for example), and sometimes weeks to set them up for operation, the time involved in this phase of preparation is a fairly fixed factor.

Unless machine-tool companies begin to build these replacement machines well in advance of "Go Day"—the date the starting signal is given car manufacturers—productive employment may be stalemated for months after Victory in Europe is achieved.

One car manufacturer has been notified that some of his bottleneck machine tools cannot be delivered before June, 1945. Similar timetables are faced by other manufacturers.

As passenger car producers depend on large chains of suppliers for many parts going into their vehicles, a big preparatory job is ascertaining whether vendors of components are ready, willing and able to resume their prewar functions. The parts maker, too, must reconvert his plants and get his production lines running.

So that parts makers will know the prime manufacturers' needs in advance, car assemblers are now engaged in bringing production drawings and material specifications up to date. The War Manpower commission recently authorized the transfer of a limited number of technicians for such work.

Replacement of tools, dies, jigs and fixtures lost or damaged during the shutdown of car production, must proceed during the make-ready period.

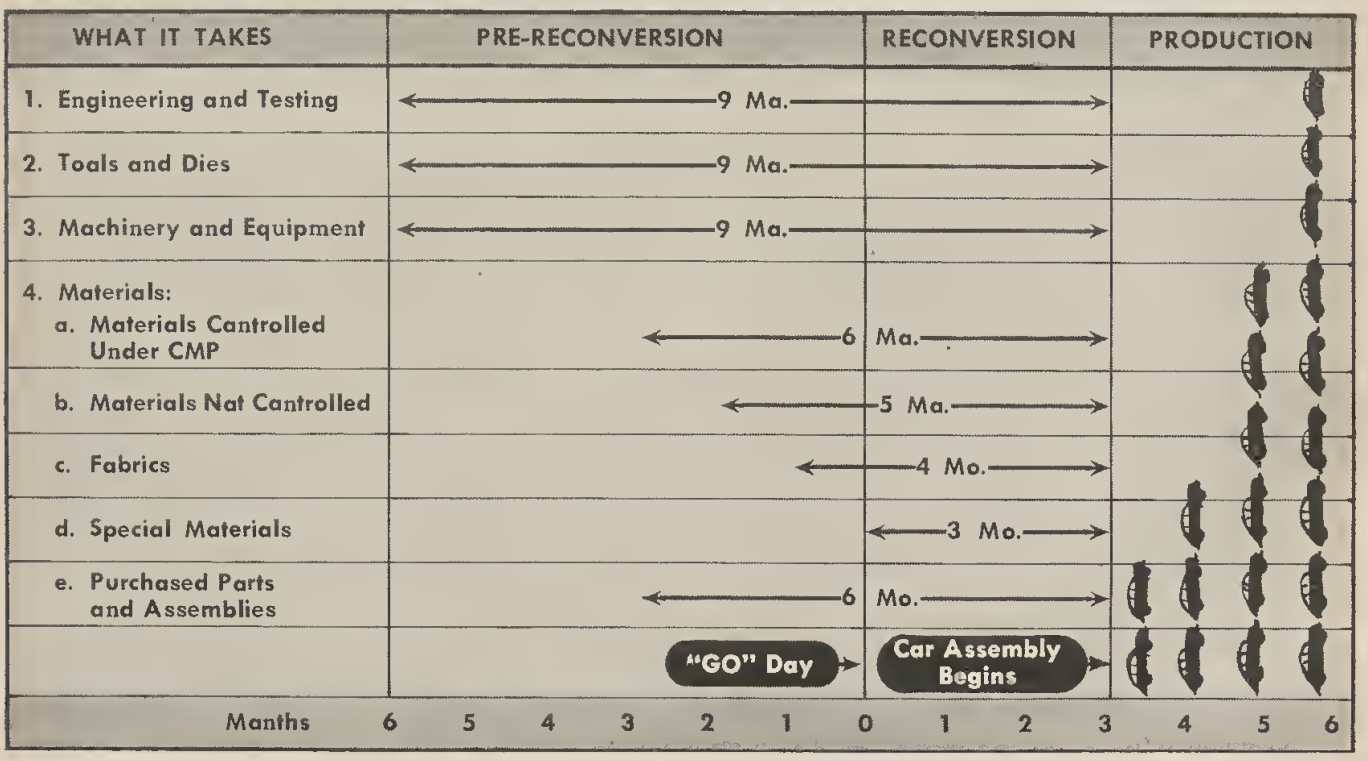
One missing die can become a barrier to speedy re-employment of many men. For example, the draw die needed for forming a tail lamp, while a small tool making a relatively minor part, nevertheless takes about eight weeks to be manufactured.

If work on it, and other missing and damaged tools, is not authorized far enough in advance of V-E Day, the resultant delays must be added to the make-ready time.

Still other factors that must be planned for are the torrents of problems that will flood in on management when war contracts are cancelled wholesale. One motor company calculates that, in its plants alone, some $50 million worth of Government-owned equipment and 100,000 tons of all kinds of material in every stage of refinement from rough billet to finished assembly, will have to be cleared out of some 17 million square feet of floor space for complete reconversion.

Obviously, the race to get cars out first will find all motor companies striving mightily to telescope time, with a great variety of shortcuts being employed. Because no two companies face the same problem, a wide time gap may separate the fastest producer from the slowest in getting the first cars out. But for the industry as a whole, certain basic time elements exist which must be taken into account in planning for reconversion. (See chart.)

THE BASIC TIME FACTORS INVOLVED IN AUTOMOTIVE RECONVERSION PLANS



THE AUTOMOTIVE STATES

Wide Range of Products Characterizes Illinois' Contributions to Industry

ON Thanksgiving Day, 1895, the first automobile road race in the United States was run in Illinois.

Two "gasoline buggies," one driven by Charles Duryea and the other by O. B. Mueller, competed over a 100-mile course stretching from Chicago to Libertyville and back.

Chicago newspaper reporters rented bicycles and set out to follow the racers. Reporting the event, one editor wrote:

"We trailed the two cars, and frequently had to backpedal to keep from running them down. At Wheeling, we stopped for lunch and let Duryea and Mueller go on. After the meal we hopped our bicycles again, and soon caught them. Past Libertyville, Duryea went into a ditch and broke a wheel, leaving it a walkover for Mueller. Results showed that for the century, Mueller made the sensational average of *eight miles an hour.*"

Since that historic event, Illinois has played a leading role in the development of the automotive industry. In the years just before World War II, durable goods—including trucks, trailers and other vehicles, parts and equipment—produced for the industry by the state's 97 automotive plants were valued at more than $88,845,000 annually.

In turn, the industry was a steady peacetime provider of jobs, and a dependable source of income for over 305,637 Illinois men and women. Sales and service and use of vehicles accounted for the largest share of employment, although 18,461 wage earners held jobs with motor vehicle manufacturers, parts manufacturers, and petroleum refiners.

Annual wages paid by Illinois automotive plants prior to Pearl Harbor amounted to nearly $14,500,000. In addition, the sale of $158,156,000 worth of petroleum products and similar commodities gave employment and provided a livelihood to over 25,000 other persons in 1940.

Taxes from the sale and use of motor vehicles constituted an important source of Illinois' prewar revenue, with motorists contributing $82,791,000 to their state government in 1940.

Today, the plants and the men and women who made possible the state's impressive peacetime automotive activity are engaged in all-out war production. One company, which formerly manufactured farm equipment in Chicago, Rock Island and East Moline, now turns out military tractors, aircraft torpedoes, shells, and bomb fuses.

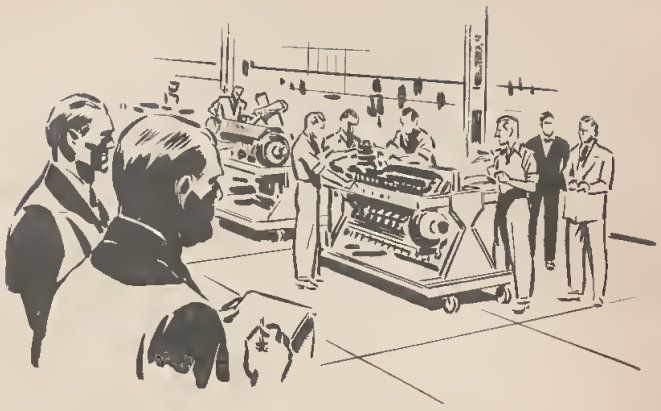
The production of engines and equipment for aircraft makes up a large part of Illinois' war output. In the Chicago area alone, several automotive companies have established special facilities to produce engines for B-29 Superfortresses and Flying Fortresses.

Half tracks and six-wheel-drive cargo trucks are made by another Illinois automotive firm—a company which formerly built farm and highway vehicles. In Rockford, a former automotive parts manufacturer makes guns and fuses. Special aircraft equipment is produced in volume at Ottawa.

In addition, other automotive plants throughout Illinois are manufacturing bulldozers, aircraft heating devices, tanks, military trailers, ammunition and marine engine equipment.

PASSENGER CARS: HOW SOON?

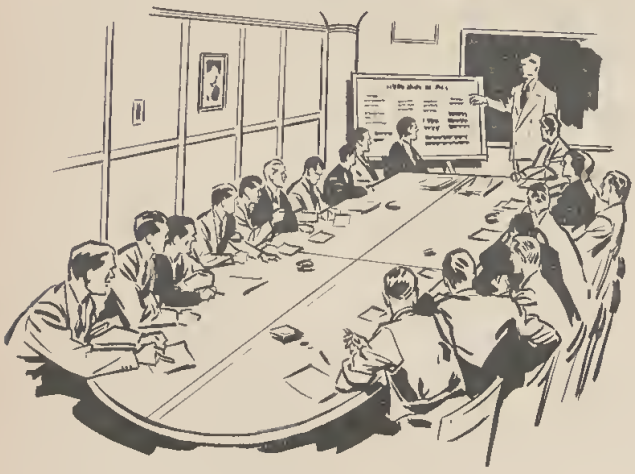
Ta gain first-hond knowledge of outomotive reconversian problems, ond to learn when cars can be made, top Woshington newspopermen leove for tour of motor plonts.



Carrespondents found componies urging quick government oction to ensure prompt plont cleoronce of wor tools ond moteriols following V-Doy, but leorned of complicotions.

The correspondents inspected mochine tools built especiolly for wor production; leorned some costing $35,000 eoch are not convertible to peocetime outomotive monufocture.

Touring o plant which used to furnish body hordwore, they sow aircroft instruments in production, ond were told thot this plont moy be tied up until Pocific wor ends.

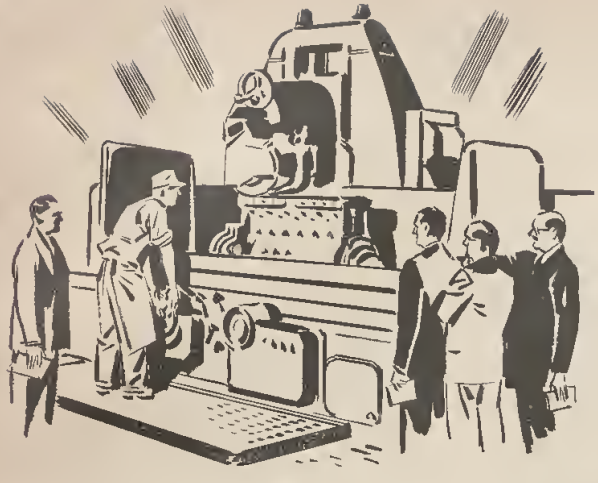


Discussing reconversion, industry leoders told correspondents thot to get progroms for resumption of possenger cor manufocture under woy, Government must oct now.

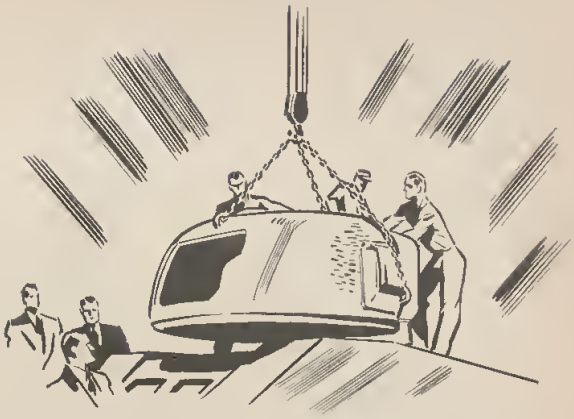
INDUSTRY'S RECOMMENDATIONS

Military agencies should assign and train their representatives now to check and approve inventory lists as they are prepared by war contractors when contracts are terminated.

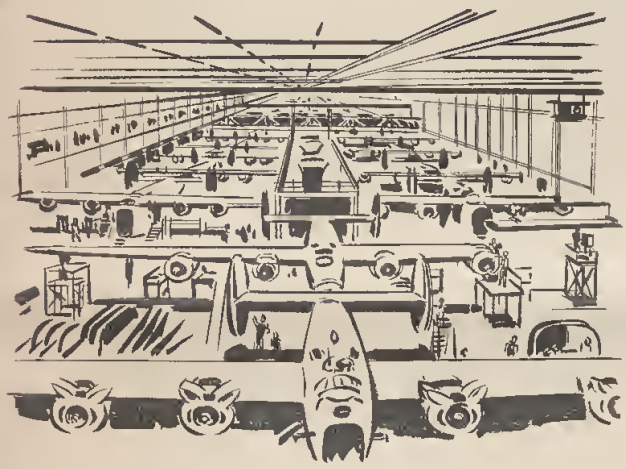
Military agencies should determine in advance of war contract terminations exactly what equipment and materials will be needed for military usage or standby purposes.



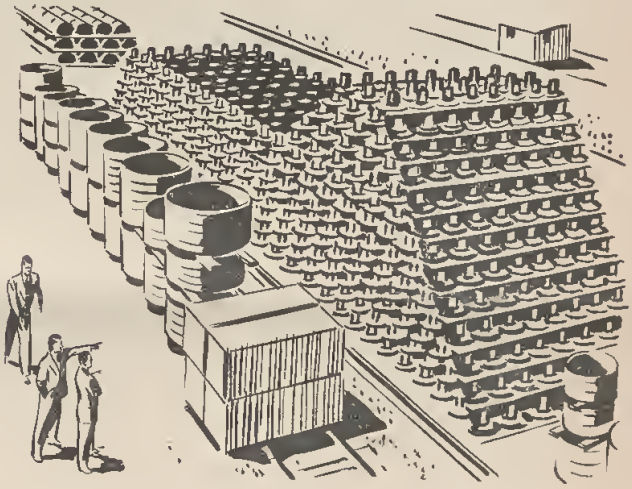
In another automotive assembly plant, they saw six separate war products being made, hearing that thousands of machines must be rearranged before cars can be produced.



At one former automobile plant, now producing engines for war, they observed 100 acres of plant space, crommed with government-owned property that must be cleared.



Viewing the mile-long bomber assembly line in a speciol-purpose war plant, they heard that most tools and parts-in-process will be useful only as scrap at wor's end.



They counted towering piles of moterials already left over from cancelled war contracts. Experts told of need for cleorly-defined procedures for prompt disposol of materials.

INDUSTRY'S RECOMMENDATIONS

When material and equipment is judged of na further military value, government shauld determine what part it wants and what part has na foreseeable use. The latter shauld be classified promptly and dispased of as scrap.

Each war cantractor shauld be advised as to gavernmental requirements far handling, staring and dispasing af different classifications af gavernment-awned terminatian inventary.

NEW AUTOMOBILES: WHEN?

Recanversian timetable:

V — 180 days (six manths befare Germany is defeated): First machine toals must be ardered; engineering and testing begun.

V — 90 days: Orders must be placed for parts, materials and subassemblies.

V — 30 days: Preparatians must be made for rearranging plants and installing new machine toals.

V-DAY (INDUSTRY IS GIVEN "GO" SIGNAL)

V-Day to V +90 days: The recanversian periad. Plants are rearranged, taals are installed, parts productian starts.

V +90 days: Assembly of first few motor cars begins.

V +180 days: Praductian af autamabiles reaches estimated rates; distribution of vehicles ta dealers naw in full swing.

First helicopter built by automotive assembly line methods is flight tested.

Industry Applies Mass Production Techniques To Manufacture of Complicated Helicopters

ONLY FIVE YEARS ago the Western Hemisphere witnessed the first successful flight of a helicopter. Today, an improved military model of this unique aircraft is being produced on automotive assembly lines—much in the same way that passenger cars and trucks were turned out.

Because of the helicopter's ability to take off and land vertically, to fly forward, backward and sidewise, and to hover indefinitely over a given area, these ships have proved to be an extremely versatile war weapon. In the Pacific War Theatre, for example, earlier models were used by the armed forces to evacuate wounded from otherwise inaccessible jungle regions and to rescue flyers shot down behind the Japanese lines. In other combat zones they have been used to carry blood plasma, to do liaison and messenger work, and to drop depth charges on submarines.

Designated the R-6 by the armed forces, the automotive-produced helicopter differs radically in appearance from the first types built in this war The new craft is a streamlined, two-place ship with dual flight control. Its tear-drop nose is made from a single piece of plexiglass and surrounds a heated, sound-proof, pilot's cabin at the forward end of an all-metal fuselage.

The technique for manufacturing the new ship was perfected by a former passenger car builder in cooperation with the Army and Navy, who developed the helicopter's latent military possibilities. Three of the company's plants, located in two different states, are linked together in a giant production and assembly line. Much of the engineering work is done in the company's former passenger car body plant. Sub-assemblies are made in a second plant and shipped to the company's former automobile assembly plant. Here the helicopter is assembled and given flight tests.

In operation, two rotors, a main and an auxiliary, control the course of the ship and give it its speed. The main rotor, which has a tip to tip diameter of 38 feet, gives the craft lift and lateral flight. The auxiliary tail rotor, with a tip to tip diameter of slightly over seven feet, acts as the rudder. A single air-cooled engine powers both rotors.

Weighing approximately 2600 pounds, the R-6 helicopter has a top speed in excess of 100 miles an hour, and a climbing rate of 4000 feet in less than seven minutes. Sufficient fuel is carried by the ship for a flight of over five hours. Ambulance litters or twin bomb racks may be attached to either side of the craft's fuselage as required.

Six-Pound Package Bad News for Japs

Contents Speed Flow Of Invasion Weapons

A $7.68 investment in airmail postage, to cover the cost of shipping six pounds of blueprints from the automotive industry to a west coast manufacturer, is helping to seal the doom of thousands of Japanese soldiers.

Encountering difficulty in making steel connecting links which join the tank treads of armored "Alligators," the west coast company turned to the Automotive Council for production help. Within an hour after the request for information was received, complete drawings were obtained from a mid-west producer who had successfully made the part. Shipped promptly by air, the drawings arrived on the Coast before another day elapsed.

In another case, the acquisition of a special machine tool from an automotive company helped an aircraft firm ease a serious production bottleneck in engine manufacturing.

The aircraft manufacturer, faced with a six-months delay in procuring a piece of equipment to finish crankshafts for the Navy's engine program, contacted an automobile company which had successfully produced a similar war product. Three days after the request was received, the badly needed production tool had been shipped by the automotive company.

These incidents exemplify the way that the automotive industry works with a large number of different industrial groups in the interest of increased war production, a practice which began just after Pearl Harbor when motor firms released 10,000 machine tools to other manufacturers.

AUTOMOTIVE WAR PRODUCTION

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GEORGE H. CUSHING, Editor
New Center Building, Detroit 2, Michigan

WAR ON WHEELS

Report From France

"ONE rainy day in Normandy, before the present war of motion had begun, I was talking to an intelligence officer of the First Army. I asked if we had any surprises up our sleeves . . . and he told me: 'The greatest secret weapon of the American Army is the 2½-ton truck.'

"He wasn't fooling. Over the beaches of Normandy we poured supplies in staggering quantities. But they would have been useless unless we could have moved them to the points where they were needed.

"So we sent over those beaches a mighty caravan of big trucks. I've seen them roll the roads of Normandy in endless lines . . . transporting men and materials of every kind.

"Having priority over all the rest were the 'red trucks'* . . . those carrying gas and ammunition. When our MP's see one of those trucks coming, everything else is waved aside. The red trucks go through.

"That, I think, is the answer to the apparent miracle of our rocket advance across Europe."

—W. W. Chaplin
N.B.C. War Correspondent

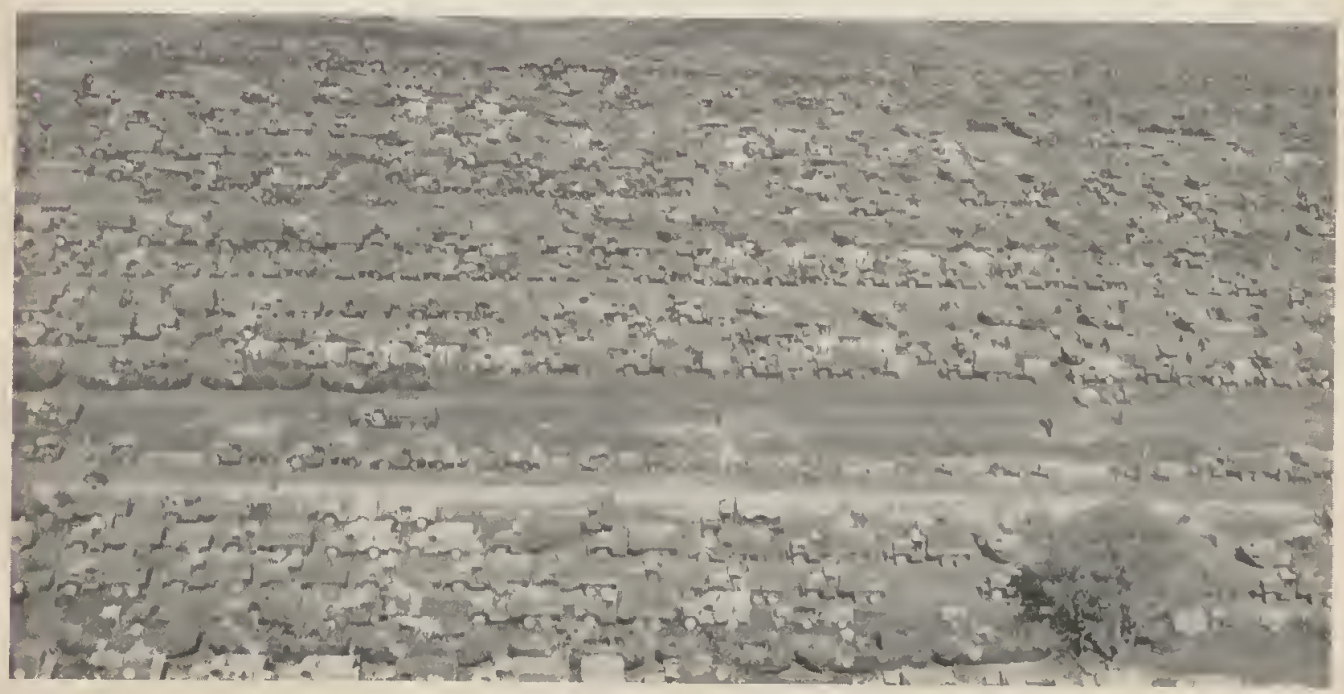
(*So called because their bumpers are painted red.)

Above: Enemy demolition foils to stop o motorized column in Fronce.

Above: "Red trucks" get top priority.

Above: Mortor crew moves into bottle.

Below: Invosion-bound—next stop Berlin!



The M-36 destrayed an average af 80 Nazi tanks a day in Western France.

Automotive Industry Announces New Weapons To Spearhead Allied Drive on Nazi Capitol

SIX NEW TYPES of assault vehicles, now rolling from automotive assembly lines in volume, have been revealed by the War Department after their baptism of fire in the battles for France.

These new weapons, the M-36 gun motor carriage, the M-24 light tank, the M-18 tank destroyer, an amphibious model of the famed "Weasel," an air-borne tank and an armored combat car, have been scheduled to spearhead the final drive on Berlin, on the basis of their performances against the best combat vehicles the Nazis could muster in the European war theatre.

Three of the new vehicles are advanced models of earlier mobile weapons, improved since the first Allied landings in Africa in response to battlefield experience, and the application of automotive research, engineering and testing methods to the original products. The others are specialized types, developed for specific tasks, much as special truck types were developed in peacetime to haul milk, farm produce, gasoline and explosives.

All six of the weapons embody suggestions made by general staff officers, GI Joes and the industry's own trained battle-front "technical observers." To these suggestions were added the best features gleaned from a study of captured enemy tanks, as well as features found in British and Russian weapons.

In general, the principal advantages of the new weapons are greater firepower, lower silhouettes, sloped surfaces for protective purposes, greatly reduced ground pressures for negotiating marshy terrains, greater maneuverability and climbing ability. Three of the vehicles are powered by standard passenger car engines.

The M-36 is a modification of the army's M-10 motor gun carriage. This new 31-ton weapon mounts a 90 mm gun and travels 30 miles an hour.

Although classed as a light tank, the 20-ton M-24, by virtue of a 75 mm cannon, packs the wallop of a medium tank. Powered by two 8-cylinder passenger car engines, which give it a speed of 40 miles an hour, it is a refinement of the M-5 tank.

The M-18 tank destroyer is a specially designed 20-ton weapon which travels 55 miles an hour; it carries a 76 mm gun with an effective firing range of seven miles.

These improved tanks and tank destroyers replace previous models in the same way that 1941 automobiles formerly were offered on the market as improvements over 1940 models. The automotive industry's efforts to meet peacetime consumer demand with a safer, more efficient car, have been diverted in wartime to satisfying the armed forces' need for faster, tougher combat vehicles, aircraft, and other weapons; these new types are some of the results.

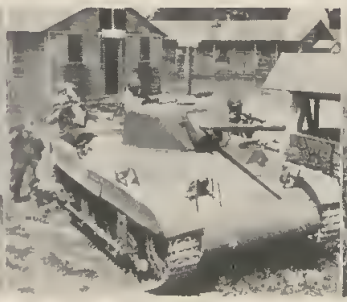
Among the new special type weapons, the "Locust," an air-borne tank, is a 7½-ton vehicle designed for operation with glider troops. It mounts a rapid-fire, hard-hitting 37 mm cannon which fires both high explosive and antitank shells. Top speed for the vehicle is 40 miles an hour.

To give the "Weasel" its amphibious qualities, a bow, a stern and two rudders were added to the original body. Its chief function is that of a cargo and troop carrier.

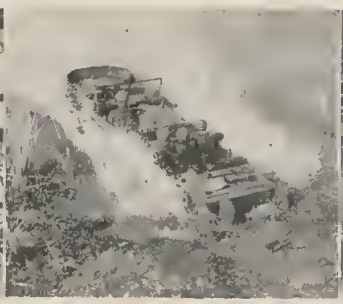
The armored combat car is called the "Staghound." Driven by a light passenger car engine, this 14-ton special-purpose vehicle carries a crew of five and was designed to counteract enemy snipers and harass supply lines.

M-18 tank destrayer

7½-tan air-barne tank



Amphibiaus Weasel



M-24 light tank

AUTOMOTIVE

WAR PRODUCTION

Vol. III No. 11 | Published by Automotive Council for War Production | November, 1944

Pre-Reconversion Work Will Speed War Output

Preparations Now Will Help Quell Employment Fears and Allow Workers to Intensify Efforts

As the war grows in intensity, more *punch* must be applied to keep war production running at peak speed in the nation.

In the automotive industry, output of fighting equipment is being maintained at a $1,000,000-an-hour rate.

But to keep war goods flowing evenly in volume to the battlefronts has been a nation-wide problem in recent months because of what national leaders term "peace jitters"—that symptom among war workers concerned with employment prospects after V-E Day.

Because jobs for millions are dependent on industry's speed in getting back into civilian work after V-E Day, the automotive industry aims at a short transition period.

The industry believes that existing fears could be greatly alleviated and that war workers would stay on war production if they could be told that adequate preparatory steps were being taken now to expedite reconversion and improve their chances for quick re-employment after V-E Day.

Only a few thousand specialists are needed to do this preparatory work, just as only a small group of military specialists were required to pave the way for thousands of men invading western Europe and the Philippine Islands.

Taking the Normandy beachhead, for instance, came ten months after the Quebec conference which planned the action. This period of planning for coming operations allowed time for the military to undertake such physical work as aerial photography, map making, charting of tides, construction of pre-fabricated ports and even testing of the soil upon which the invasion armies were destined to march.

Before the great invasion armada could move across the English channel, all preparatory work was completed for the thousands of men and machines participating in the offensive: food, fuel, ammunition, supplies were all ready.

Likewise, before great numbers of workers can return to civilian jobs after V-E Day, essential work that is preparatory to reconversion must be completed by technically-skilled specialists.

To help effect reconversion of the automotive industry, whose peacetime factory employment normally is half a million men, the services of about 12,000 workers in the machine tool industry and tool-and-die shops are required for a few months on work that must precede any changeover.

In addition, work of technicians in analyzing material specifications has to go forward, and now passenger car companies are authorized to use up to 1% of their War Manpower Commission employment ceilings for this purpose.

A few plant layout men in each company also must per-

(Continued on Page 4)

Automative-built gliders, carrying 45 men, perfarm special invasion tasks.

Giant Sail-Planes Emerge from the Converted Woodworking Facilities of an Automotive Firm

DOWN from the skies on D-Day came huge, silent airships, quietly taking the first invasion troops into the western end of Fortress Europe. Though no motors powered the tremendous craft, many were the products of the motor industry—giant gliders with wingspreads nearly as great as that of medium bombers.

Some of the larger ones carried 7½-ton tanks, jeeps, machine guns, light field artillery, food, medicine, clothing and the other mountains of supplies necessary for full-scale offensive operations. Others were smaller ships, carrying highly-trained combat troops.

Spectacularly executed—newspapers reported "50-mile glider trains"—the surprise airborne operation was the final link in a chain that had long been planned by both the War Department and American industry.

To get troop and cargo-carrying gliders in sufficient volume, the War Department had turned to the automotive industry many months prior to Invasion Day. The automotive company selected to produce the motorless ships had manufactured trucks and station wagon bodies in peacetime, and thus possessed a nucleus of skilled woodworkers.

Four months after blueprints had been received by the company, a 15-passenger troop-carrying ship—the first glider to be built by modern automotive production methods—was ready for its test flight.

In the first month of the conversion period the company stripped three large plants of peacetime productive equipment. Machines, some of which had been in service for approximately 15 years, were unbolted from floors and hauled to storage, or shipped to other manufacturers. Out of 300 peacetime machines in one of the plants, less than 100 were found adaptable to glider work.

New production equipment was quickly moved into the three plants and set up. In addition, more than 4,000 fixtures had to be designed and located. Among these were fixtures capable of holding an entire wing, a job formerly considered bench work. Another was a fixture which forms six bow tips at one time. a third was a rotating bed for shaping glider wing ribs.

By pre-fabricating most details, as in the automotive progressive assembly system, company engineers were able to utilize conveyor lines, thus eliminating a great deal of the handling between fixtures. Common practice in glider construction has been to mount partially completed assemblies on wooden horses, with workmen moving the dollies by hand from station to station.

Except to adapt the fabrication of parts and subassemblies to automotive mass production methods, the basic design of the ship was not changed by the automotive engineers. The manufacture of tools was divided between the company's main tool shop and 30 smaller toolmaking firms.

Shortly after construction of the smaller glider had reached volume proportions, test flights on a new and larger model were begun by the company early in 1944. By April the first production model of the new ship was delivered to the Air Corps. Currently, the company is in volume production on both models, with more than 2,000 of the smaller ships already having been turned over to the armed forces.

Several new features have been incorporated into the large glider. Among these are wing flaps to control take-off and landing speed, and a special nose section which permits rapid loading and unloading of cargo and troops. Two landing gears, a conventional tricycle gear with hydraulic brakes and a pair of fixed skids for use in limited areas, are standard equipment.

In addition to pilot and co-pilot, the new ship carries in the neighborhood of 45 fully equipped soldiers; and is large enough to transport two jeeps, or a howitzer and one jeep complete with crews and ammunition.

Motor Company Builds New "Super-Bazookas"

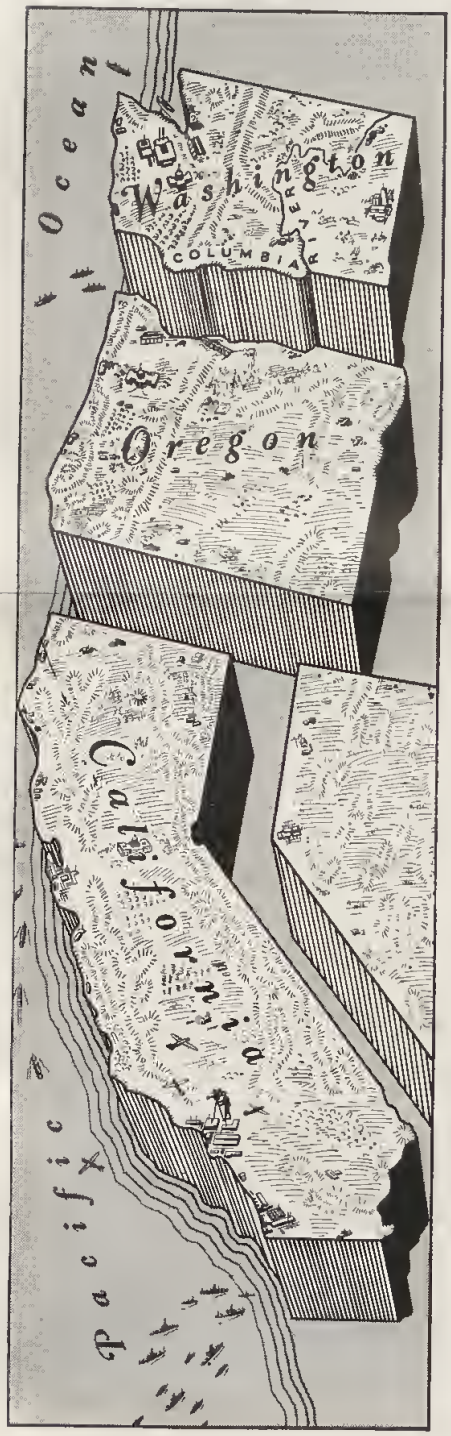
MOTORS to propel heavy calibre rocket shells, a new type weapon being used on invasion barges, are now produced in volume by an automotive company.

Dubbed "super-bazookas", the deadly rockets are jet-propelled and provide a fierce concentration of fire power. Landing craft equipped with the new weapons mount strange appearing multiple-barreled mechanisms which are capable of firing several big rocket shells simultaneously.

The rocket motor itself is comprised of a long fuel chamber, directional guiding vanes and electrically fired percussion contacts. Unlike the conventional heavy-duty shell, the velocity of the rocket shell increases as the projectile speeds towards its objective.

THE AUTOMOTIVE STATES — NO. 5 OF A SERIES

West Coast Motor Activity Provided Peacetime Jobs for 700,000 Workers



TWICE the wealth was created annually in California's automotive factories during prewar years as was wrested from the earth at the peak of the state's historic Gold Rush.

And in the last years of peacetime production more than five times as many people were employed in automotive activities in the "Golden State" as flocked westward during the rush of the Forty-niners for yellow riches.

Although California is by far the largest West Coast contributor to the industry, its neighboring states of Oregon and Washington also have a share in the production of automotive goods. As a leading automotive manufacturing area—there are 43 plants in California, Oregon and Washington—the states bordering the Pacific Ocean produced approximately $122,000,000 annually in durable goods for the industry during peacetime years.

With more than 26,000 men and women employed in vehicle manufacturing, parts and tire manufacturing and petroleum refining, the Pacific Coast region ranked among the important employers of automotive workers in the United States before the war. Annual wages paid by the West Coast's automotive plants in peacetime years aggregated more than $13,700,000.

In addition to those directly connected with automotive manufacturing, many thousands of the West Coast's men and women earned their livelihoods in activities stemming from the motor vehicle industry. In 1940, approximately 567,217 persons in the three states earned paychecks in jobs connected with the sales and service and use of motor vehicles.

Another important source of income for West Coast folks was the gasoline filling station. In the year before the war, workers in the three states' 22,478 retail outlets sold more than $333,000,000 worth of petroleum products and other commodities.

The sale and use of motor vehicles in California, Oregon and Washington, annually made up an important part of each state's peacetime revenue. In 1940, for example, motorists on the Pacific Coast paid a grand total of $142,681,646 in taxes to their state's exchequer.

The great stretches of land between key cities on the Pacific Coast and the need for reliable means of communication to integrate the economic activities of the three states has given highway transportation an important role in the region. In 1940, for example, the combined vehicle registrations in California, Oregon and Washington equalled 11 per cent of the total vehicles registered in the entire United States. California alone has consistently led all other states in the union in the number of vehicle registrations, having one car to every 2.8 inhabitants in 1940.

Since the day Japanese bombs rained on Pearl Harbor the West Coast states have been a mighty contributor to the United Nations arsenal. Industrial payrolls have jumped 200 to 300 per cent over prewar levels, and the thousands of automotive workers trained in peacetime mass production skills formed a nucleus around which several of the Pacific Coast's war production facilities have been built.

The former automotive factories on the West Coast have felt the impact of this tremendous wartime industrial expansion. At Southgate and Oakland, California, plants which formerly assembled cars were converted to tank production. When this contract was recently completed, these facilities were turned over to other war producers.

Richmond, California, is the home of another automotive assembly plant which today performs as an important modification center for the Army and Navy. Here trucks, tanks, amphibious vehicles and other automotive combat equipment is readied for war. Marine engines, tractors and bulldozers come off production lines in Sunnyvale, and alligators are produced in Los Angeles.

AUTOMOTIVE EMPLOYMENT ON THE PACIFIC COAST

Manufacturing, Tire and Petroleum Refining	26,078
Sales and Service	139,431
Federal and State Roads	13,397
Truck Drivers	403,300
Bus Drivers	11,089
Repair and Service Establishments	21,271
Vehicle & Parts Dealers	34,691
Accessory, Tire and Battery Shops	8,154
Gasoline Filling Stations	45,297
Total	702,708

Industry's Ability to Re-Hire Workers Quickly Governed by Extent of Pre-Reconversion Work

(Continued from Page 1)

form the equivalent of industrial map making—charting the path each pound of raw material and each automotive part will follow in moving from loading dock to assembly line.

After V-E Day when war contracts are drastically curtailed, a trained industrial task force must move in to clear factory space, just as a small military task force clears a key road junction in advance of the main assault.

Advance decisions made now on plant clearance procedures, as well as pre-determination of inventories, would allow the industrial task forces to operate at high speed after V-E Day.

Building of bottleneck tools is, of course, one of the important pre-reconversion activities that must be undertaken well in advance of resumption of motor vehicle production. Work of this type differs as much from actual reconversion as pre-invasion preparations do from invasion operations.

Automotive observers cite the open machine tool building capacity now existing as a great opportunity for pre-reconversion spade-work. Machine tool shipments, once at a peak of $132,000,000 monthly, are now at a $40,000,000 monthly level. Numerous tool builders have turned to straight production work, occupying themselves in tasks far beneath their greatest potential skills and doing jobs which could be done by other firms with less skilled personnel. Employment in the machine tool industry has declined more than 35% since the first of the year—while the automotive and other mass production industries face a need for sizeable quantities of precision machines which no one else can build.

Surveys reveal that the automotive tool and die industry has had a 20 per cent employment drop also and is in a position to undertake some pre-reconversion work on automotive tools and dies which must be on hand before production lines can begin operating.

By getting authority to take adequate pre-reconversion steps in advance, utilizing personnel not fully occupied on war work, the automotive industry is convinced that current production will not suffer and the war effort after V-E Day will be helped. For the scheduling now of work that will allow a more orderly transition to combined war and civilian operations after V-E Day will reduce what could be a major home-front problem—wherein some workers would be producing to beat the Japs and others would be awaiting employment in plants still trying to switch to civilian output.

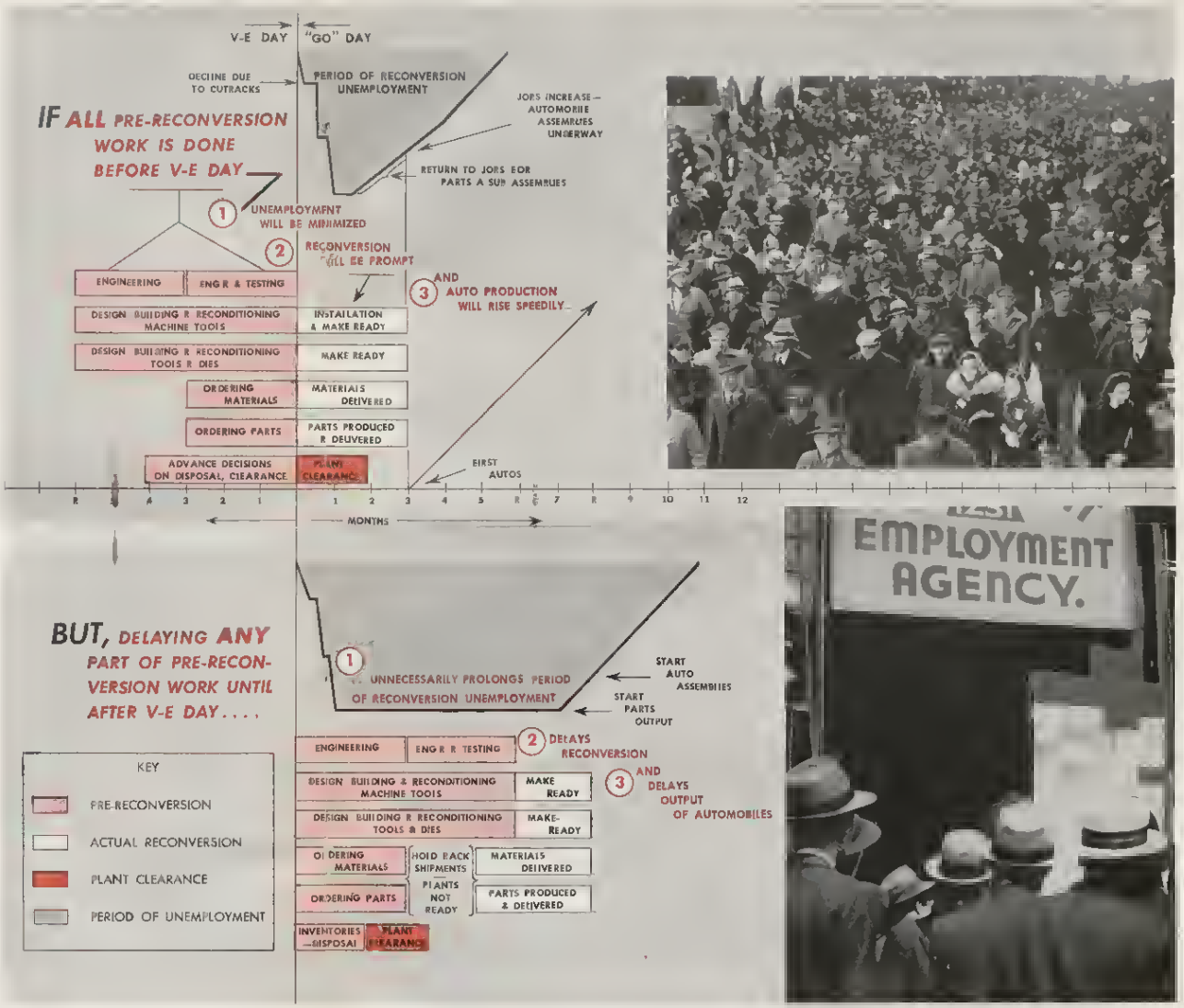
When actual reconversion comes, how big a job will it be for producers? Here's the problem faced by one automotive company.

Before Pearl Harbor, this company used 3,900 machine tools in a mile-long plant to manufacture automobiles. Now its facilities are engaged entirely in war work, and 2,000 of these machine tools have been rebuilt or retooled for war production, while 300 of them have been sold to other companies holding war contracts.

To these 2,000 company-owned machine tools some 8,000 pieces of government-owned equipment were added, but every one of these 10,000 machine tools must be moved before peacetime commodities can be manufactured. All 8,000 of the government owned machines, minus what the government may sell to the company must be skidded, cleaned, greased, packed, crated and loaded for removal to a storage depot.

In addition, over $21,000,000 worth of special tools, jigs, fixtures and gages must be inventoried and readied for removal, and $56,000,000 worth of aviation engine parts in various stages of development must be disposed of according to the government procedures. The time required for clearance of plants for quick peacetime production will depend heavily on how fast such dispositions are taken care of, and delays awaiting official decisions must inevitably mean undue length of the reconversion unemployment period.

The company must acquire at least 300 special machine tools in order to replace those sold, and must have additional work done on most of the 2,000 now adapted to war work before it can resume peacetime production. Even then, these tools will be useless until certain other mechanical needs are filled, and as a result, the company has calculated that almost six months of preparatory tool work must precede the start of motor vehicle production.



"Gromps" occupies o ploce of honor in the Smithsonian Institute.

Two Venerable Jeeps Crash Famous Portals to Join Ranks of Other National Immortals

Now come two homely jeeps to join the immortals of American history —one in the dignified atmosphere of the Smithsonian Institute in Washington, D. C.; the other in the ranks of heroes who have won honors on foreign battlegrounds.

"Gramps," the venerable jeep now occupying a choice spot at the Smithsonian, was called to this Valhalla after an extensive search through Army records for the "oldest" jeep. The vehicle, given its nickname by the men who used it, was found at the Jeffersonville Quartermaster Depot where its record showed it to be the oldest jeep left of the original 62, two-wheel-steer models built by an automotive company in 1940.

When finally located it was still tearing around the military post in the capacity of a staff car, as chipper as the day it went off to war, despite a few spare part injections. Bearing the registration number USA-2015330, "Gramps" obeyed orders from his superiors and rolled into the white light of posterity's view as a permanent historic exhibit.

Even more unusual, perhaps, is the honor awarded to "Gramps'" rival, the Marine Corps' "Old Faithful", a jeep which served four Marine generals through the Guadalcanal campaign and the Bougainville invasion.

"Old Faithful" was officially presented with the Purple Heart medal for "wounds", two shrapnel holes through the windshield, received in line of duty during the battleship shelling of Guadalcanal on October 13, 1942.

The only American vehicle to be so decorated, "Old Faithful" was retired from active service by official Marine Corps order on December 22, 1943. Its motor, which had never been overhauled, purred as smoothly on the day of retirement as it did on that historic August 7, 1942, when it first rolled onto Guadalcanal's famous Lunga Beach.

During its tour of duty in the South Pacific, "Old Faithful's" passengers included, among many others, such distinguished persons as the late Secretary of the Navy Frank Knox, Admirals Chester Nimitz and William Halsey, Vice Admirals Aubrey W. Fitch and John S. McCain, Marine Corps Commandant Lieutenant General Thomas Holcomb, and his successor, Lieutenant General A. A. Vandegrift.

In 1944, after a long overseas journey, "Old Faithful" was enshrined in the Marine Corps Museum at the Marine Corps Air Station, Quantico, Virginia.

French Motor Factories Never Tooled for War

American Automotive Conversion Is News

Despite German occupation and American bombings, French automobile manufacturing plants are in excellent shape to resume the production of civilian cars, an American Army officer in France recently reported.

The officer, an automobile dealer in civilian life, wrote friends on September 21:

"I have been simply astonished on entering large French plants to find them exactly as they were on their last day of production of civilian passenger vehicles.

"While discussing this matter with the managing director of a leading French manufacturer, the gentleman agreed that had the French automobile industry mobilized itself as completely and wholeheartedly as has the American automobile industry, the occupation of France could probably have been averted.

"This remark was made when, with amazement, this Frenchman and his associates learned for the first time that the American auto industry had completely ceased production of civilian cars, had stripped their factories, rebuilding and greatly enlarging them for total war production. The Frenchman asked:

" 'What did you do with your tools, dies, presses, etc.?'

"He held up his hand in a gesture of admiration when informed this equipment had been stored, many times in the open, the only protection being preserving oils and greases and coverings of waterproofed packing or storage materials."

AUTOMOTIVE WAR PRODUCTION

Published by

WAR PRODUCTION INFORMATION DEPARTMENT

Automotive Council for War Production

GEORGE H. CUSHING, Editor

New Center Building, Detroit 2, Michigan

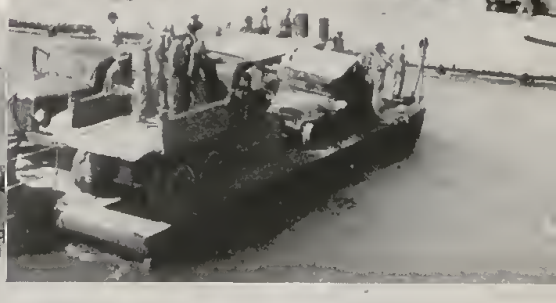
WAR ON WHEELS

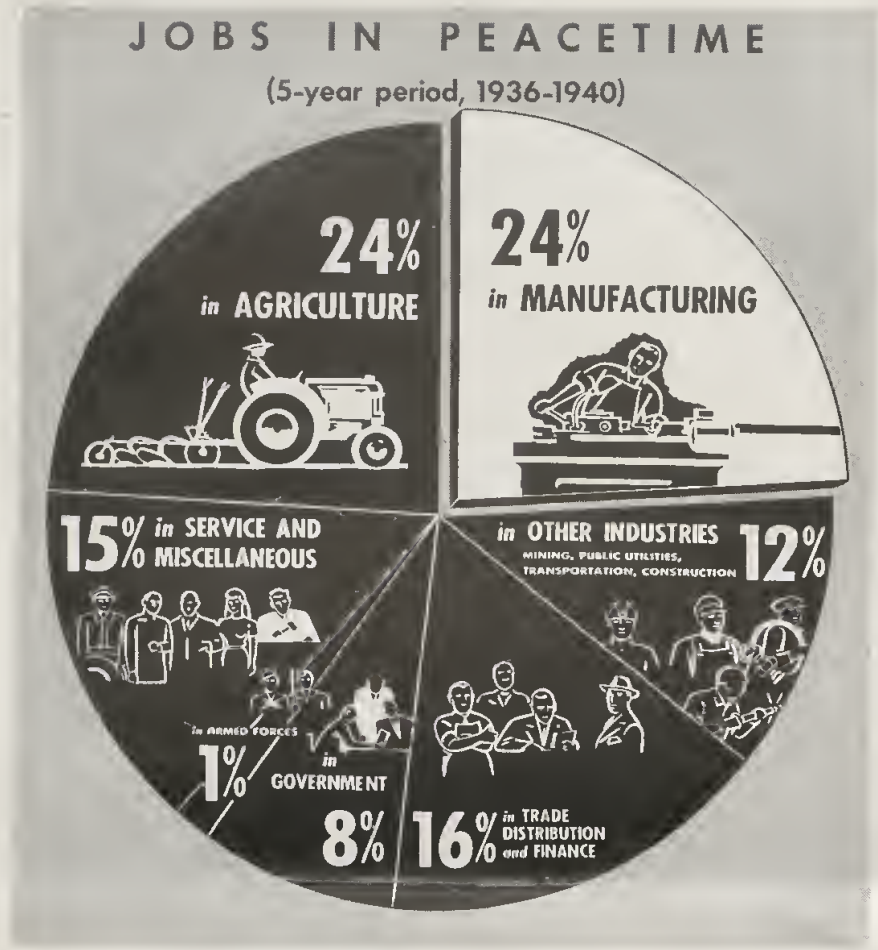
IN amphibious warfare, military vehicles swarm ashore right behind the first wave of assault troops. When American soldiers hit the beaches of Normandy on D-Day, for example, one military vehicle was landed for every five men—six times as many general and special purpose vehicles as the AEF possessed on Armistice Day, 1918.

The landing craft shown in the accompanying pictures, piled high with motorized equipment, give some idea of the use to which the Army and Navy put the tools of modern warfare supplied by the automotive industry.

According to a recent Army announcement, "if all of the army vehicles now in the European Theatre of Operations were formed into a line with a road spacing of 60 yards between vehicles—the Army regulation for convoy spacing in combat areas to minimize air and artillery attack—the vehicles would extend from New York to San Francisco, back to New York, and then westward again to Omaha, Nebraska." In United States road mileage this is equal to a distance of 7,711 miles.

If this gigantic convoy were closed up, so that each vehicle touched the one in front of it, the line would extend from Washington, D. C. to St. Louis, Missouri, over 815 miles.





Jobs in Industry Comprise Just One Source of Employment Opportunities in Peacetime

WAR production has already attracted many ex-GI Joes to the factory, where they are speeding the output of military equipment needed by men still in uniform.

Of the thousands* of World War II veterans who have gone into automotive plants since their discharge from service, 55% are brand new to the automotive industry. By comparison, 28% of the war veterans now employed in steel plants never worked there before.

While there is no way to determine exactly how many jobs industry will provide for *old* and *new* employes after the war, it is apparent that only a portion of the employment generated by industry will be in factories.

Whether factory employment itself is high or low in the years following the war depends, of course, on the number of cars and trucks manufactured in response to the customers' demands.

The high prewar level of automotive factory employment was attained in 1937, when automobile, body and parts factories provided 517,000 jobs. Today the comparable employment in war work is approximately 800,000 persons, many of whom never worked in industry before.

However, manufacturing is only one phase of the automotive industry's peacetime job reservoir.

Before the war, there were 1,300,000 persons engaged in the sales and servicing of motor vehicles, enough people to populate a state the size of Nebraska.

A vast peacetime army of men, some 3,700,000 of them, had jobs as motor truck drivers in prewar years. The building of state and federal roads required another 233,000 persons. Bus drivers totaled 142,825.

And, in addition, thousands of workers mined the ore, gathered the wool, sewed the upholstery used in automobiles. Other thousands sold automobile insurance, helped in financing, prepared advertising—jobs created as result of automotive work. Still others worked for railroads, ship and truck lines that transported the materials to the factories and hauled new cars away.

The fact that only a portion of peacetime jobs will be found in factories will hold true of all industry in the United States.

Throughout the nation, only one out of four gainfully employed persons in peacetime worked in the general field classified as manufacturing. Of equal importance were farming, forestry and fishing which provided 24% of the total employment, or 11,000,000 jobs.

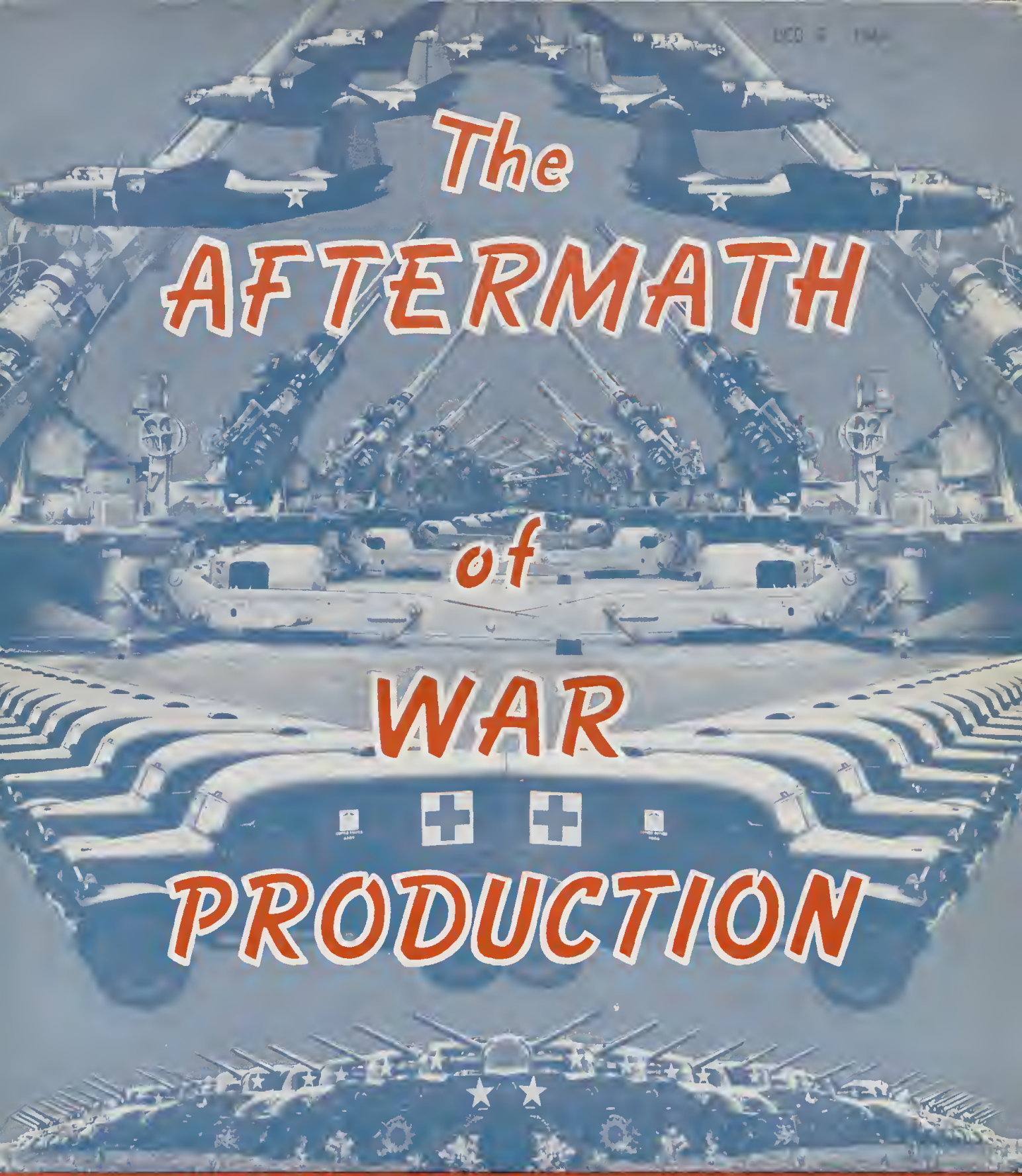
In 1940, more than half, or 52 per cent, of our working population was employed in fields other than manufacturing or farming and allied activities. Sixteen per cent of the total, or 7,500,000, handled our trade, distribution and finance; 15 per cent, or 6,500,000, provided us with personal, professional and recreational services; 12 per cent, or 5,500,000, were engaged in mining, construction, transportation and public utilities; 8 per cent, or 3,700,000, worked for the federal and subdivisions of government, and 1 per cent, or 400,000, were in the uniform of the armed services at that time.

Just as the automotive industry will expand and provide jobs in proportion to increased public demand for cars, so too, may other fields be expected to provide increased employment possibilities. Published surveys indicate that radio sets, washing machines, refrigerators and other manufactured commodities also rank high on the postwar purchasing lists of American families. The extent of these postwar sales will determine the extent of factory employment nationally.

At the same time, however, American people will continue to patronize restaurants where they can dine without delay; stop at a filling station for a quick tire change; have laundry picked up and delivered in a minimum of time. These and many other normal services will require men and women, many of whom are today holding war jobs in factories and elswhere.

In the last two decades, employment in trade and service establishments has gained, at the expense of manpower engaged in manufacturing and agriculture. Economists point to this as a healthy trend, contributing largely to our world-high standard of living.

*18,170 World War II veterans had been hired up to date of last survey in motor industry.



The AFTERMATH of WAR PRODUCTION

A Motion Picture Study of Surplus War Materials Disposal

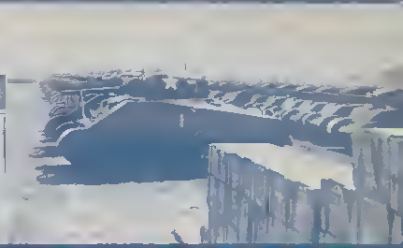
The AFTERMATH OF WAR PRODUCTION

A Study of the Disposal of Surplus War Materials

When World War I production stopped in 1918... war equipment worth millions of dollars was on hand...

tires, trucks, guns, clothing and dozens of other items.

Retail stores sold some of it, but much was scrapped.



The end of this war will also leave huge surpluses...

war contracts will be quickly cancelled...

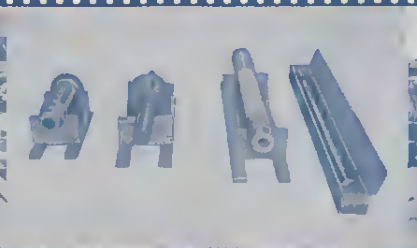
products, tools and parts will jam factories.

In a typical cancellation of a tank contract recently...

the surplus material and tooling cost was $80,000,000.

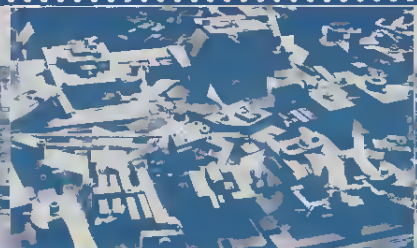
$25,000,000 worth of material was "usable as is"...

manufactured items costing $38 million were scrapped...

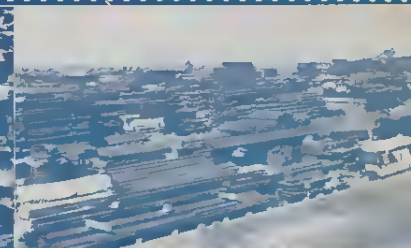


perishable tools worth $5,000,000 were left over...

2,691 special jigs and fixtures remained on hand...

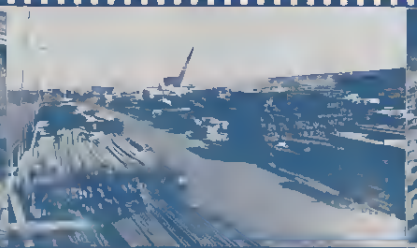


along with 1,260 metal dies valued at $2,500,000.



Surpluses occupied acres of outdoor storage yards...

and much valuable factory production space.



Quick, efficient disposal of surpluses is necessary...

to free plant facilities for peacetime production...

to avoid industrial stagnation and unemployment.

• • • • • *Scenes from a 17-minute sound motion picture produced by the Automotive Council for War Production.*

THE END

16mm prints are available to luncheon clubs, schools, farm and civic groups without charge upon request to the Council.

The speed of industrial reconversion is directly connected to plant clearance. And prompt plant clearance is impossible without the quick and efficient disposal of surplus war materials—billions of dollars worth.

Here, in motion picture form, is a study of surplus war materials disposal, a problem that will have a direct bearing on the thousands of postwar jobs on which the nation must depend for sound prosperity.

What happens when a big war contract is cancelled? You will see the answer, taken from a case history of an automotive company. The acres of equipment, mountains of partially-fabricated materials, buildings and yards jammed with parts—from a terminated tank contract—all are shown for the first time in motion picture form.

What is the plight of aircraft producing companies? What is the aftermath of design changes on bombers, for example? What happens when the assembly line is halted in midstride by an order to "Stop Production!"?

What decisions must be made on the spot to avoid delay in disposing of surpluses? What is the salvage value of special tools? Of dies, jigs and fixtures? Is there any advantage in dismantling such materials to salvage usable parts?

These are some of the questions that arise in any consideration of surplus war materials disposal, and information leading to a more accurate conception of the answers is contained in this film. Here is one of the nation's biggest problems, a problem that will be bigger than ever during reconversion.

THE AFTERMATH OF WAR PRODUCTION

Every business man, farmer, editor, public official, factory worker, student . . . . . in fact, every American who is looking forward to a better postwar America, should see this picture.

You may borrow a print of the picture, in 16 mm., with sound, by writing its sponsors.

AUTOMOTIVE COUNCIL FOR WAR PRODUCTION

320 New Center Building

DETROIT 2, MICHIGAN

AUTOMOTIVE WAR PRODUCTION

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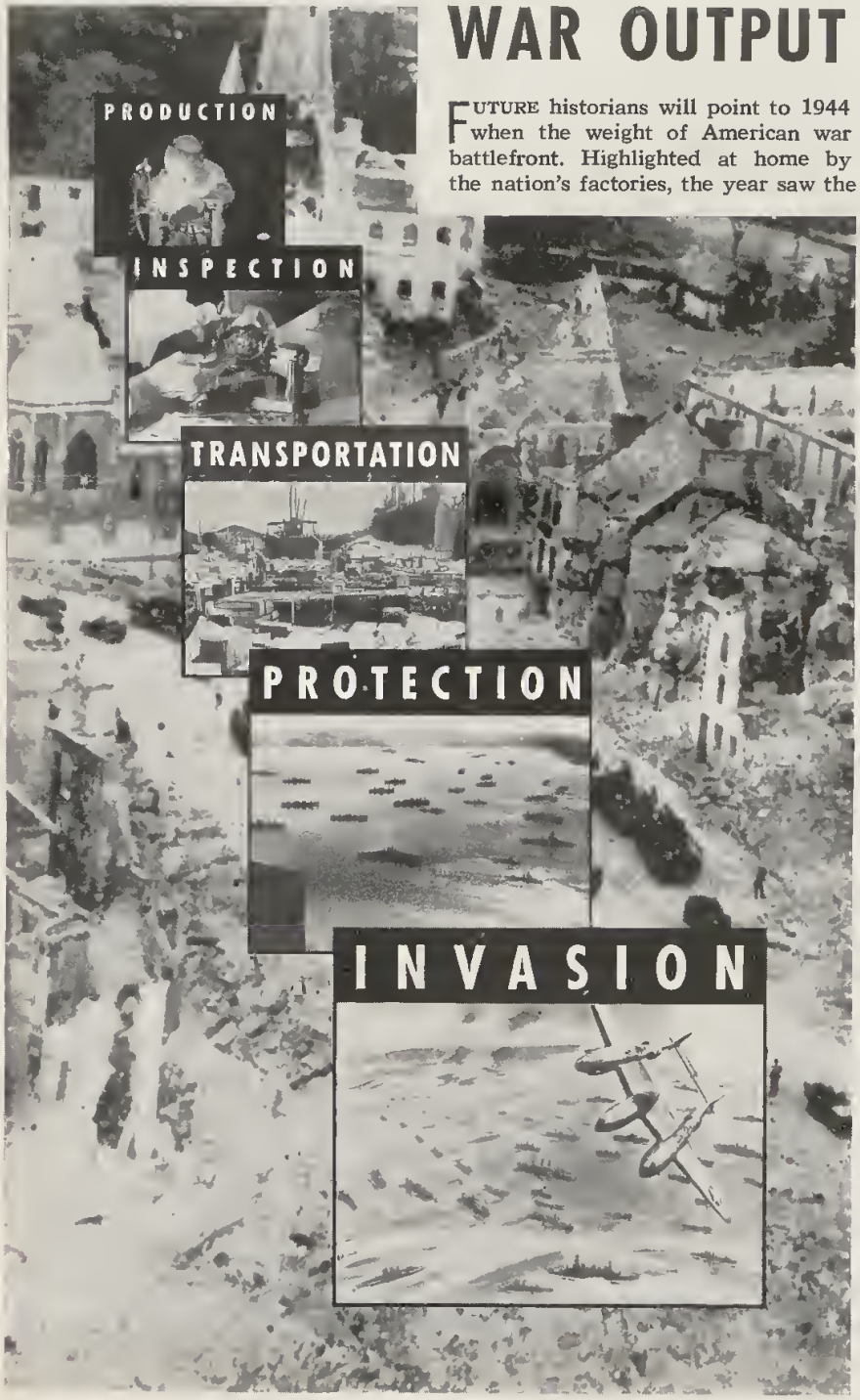


WAR OUTPUT AT NEW HIGH

FUTURE historians will point to 1944 as *the* year of decision and action, a year when the weight of American war production tipped the balance on every battlefront. Highlighted at home by peak deliveries of war materials from the nation's factories, the year saw the military cycle—which starts with production and carries through with invasion and assault on the enemy's homeland—revolve twice striking at Europe in the spring and at the Philippines in the late fall.

In the automotive industry, production of aircraft, tanks, military vehicles, guns, marine equipment, ammunition and a host of other items needed by these Allied invasion forces achieved a rate in excess of $10,000,000,000 annually. This included an output of over $700,000,000 worth of essential replacement parts authorized by the government to maintain the country's rolling stock of passenger cars and trucks during wartime.

Production and deliveries of war materials by the automotive industry in the past year reflected the increased tempo of allied military activities throughout the world. In 1944, the value of war products delivered by the industry to the armed forces amounted to $9,320,000,000, an increase of eight per cent over the preceding year and nearly double the value of the industry's output of civilian goods in 1941, its peak peacetime production year.

In one major automotive production center, war contracts averaged $3,800 per capita, three times the national average. Since Pearl Harbor, this manufacturing center has been awarded a total of $21,584,000,000 in prime contracts, or 12.3 per cent of the national total. In addition, the area holds several billions worth of sub-contracts.

The manufacture of aircraft and aircraft parts held top spot in the industry's war production program during 1944. Equipment delivered to the Air Corps was valued at $4,200,000,000, or 13 per cent more than the valuation placed on all the automobiles and

(Continued on Page 2)

Automotive equipment speeded the advance across France.

Automotive War Deliveries Over Nine Billion In 1944; Increase Eight Per Cent in Past Year

(Continued from Page 1)

trucks produced by automotive plants in 1941. One company reports that 4,600 four-engine bombers have been produced in its facilities in the past 12 months.

Military vehicles and parts production was second in importance, based on dollar value, with $2,500,000,000 reported for this category. Next came tank production with $1,050,000,000, followed by marine equipment, $680,000,000; guns $375,000,000, and ammunition, $240,000,000.

Other war products, a list extending over 300 different types of items, made up the remaining $275,000,000 in deliveries.

Since the start of the industry's war program, automotive plants have produced 4,700,000 guns, ranging in size from .30 calibre carbines to giant "stratosphere" anti-aircraft cannons. One company alone recently announced that it had turned out 1,000,000 infantry machine guns since the day its plants were converted from civilian goods production to arms manufacture.

Some 2,240,000 military vehicles, from jeeps to huge 10-ton cargo trucks, have rolled from assembly lines towards battlelines during this time. One company delivered its 150,000th heavy-duty truck in 1944.

Engines by the carload have come from automotive plants since war work replaced civilian work. By late 1944, the number of power plants produced by the industry for military vehicles, PT boats, landing craft, fighter planes, bombers and the new Superfortresses reached the 3,100,000 mark.

Indicating the size of the industry's engine production program, four former motor car manufacturers have produced a grand total of 191,000 aircraft engines for use on Liberator bombers, Flying Fortresses and military cargo planes. Another company has built over 50,000 engines for PT boats, motor torpedo gun boats and fighter planes. Two more companies have manufactured a wartime total of 104,000 engines for invasion craft, with one of these firms now supplying all the power units used by the Navy in its large variety of landing craft, while a former passenger car assembly plant has delivered more than 15,000 medium tank engines to the Army Ordnance Department.

The key to this production drive is to be found in the cooperative efforts of over 500 large and small automotive manufacturers located in 31 states—manufacturers who cast aside competitive endeavors at the time of Pearl Harbor and applied their individual efforts to making the production team work smoothly. Supporting them is a nation-wide chain of sub-contractors of every size and description located in 1,375 cities in 44 states. Most of the latter are small businesses, 63 per cent employ less than 500 persons, but their production record is an important part of the automotive industry's entire program since these small plants often furnish as much as 98 per cent of a finished product.

Average weekly employment in the plants of former motor vehicle and body manufacturers showed a slight over-all rise during the year. Similarly, average weekly payrolls moved upward as did the size of the average weekly paycheck.

In 1944, average weekly employment stood at 755,000, a two per cent increase over the preceding year. In addition, several hundred thousand persons are employed in war production by former automotive parts companies, most of which hold sub-contracts for war materials to be furnished the larger automotive plants. Some parts companies do, however, hold important prime contracts.

The average weekly payrolls in the plants of former vehicle and body manufacturers amounted to $43,600,000 during the past year, while workers received an average weekly paycheck of $57.70.

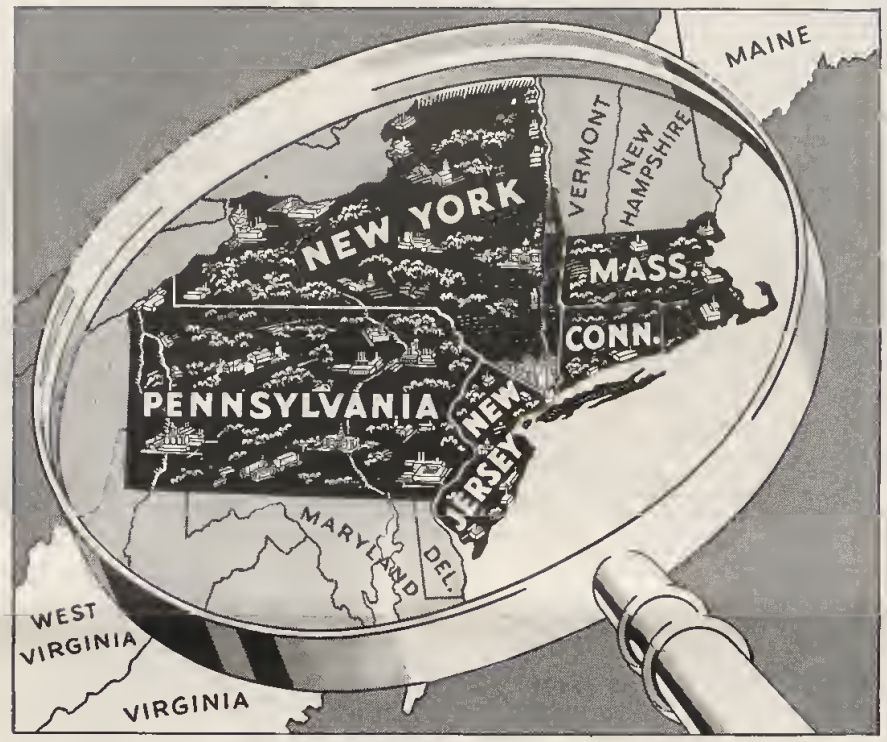
Having filled $22,920,000,000 in war goods orders since Pearl Harbor, the automotive industry will enter 1945 with a backlog of work in excess of $11,080,000,000.

Of these unfilled orders, the largest percentage will be contracts for aircraft, aircraft engines, propellers and other aircraft parts. Next in line, based on dollar volume, will be military vehicles, tanks, marine equipment, guns, ammunition and sundries; with heavy-duty trucks and ammunition holding top production priorities at least until V-E Day.

Also of great importance to the nation's war effort during the coming year will be the automotive industry's programs to develop and place in mass production several entirely new types of weapons. Among these, the outgrowth of military events in Europe, are robot bomb engines and jet-propulsion units for an advanced fighter plane, now under test by the Air Corps.

THE AUTOMOTIVE STATES — NO. 6 OF A SERIES

Work in Five East Coast States Creates 1,500,000 Peacetime Jobs



JUST a half century ago, when there were only four automobiles in the United States, a New York publisher brought out the first issue of the *Horseless Age*, a trade magazine, which contained this prophetic statement:

". . . Those who have taken the pains to search beneath the surface for the great tendencies of the age see what a giant industry is struggling into being."

Four years later, in 1898, a Massachusetts manufacturer made the unprecedented announcement that 50 automobiles had been produced and sold in a 12-month period. In quick succession, a "stable" for renting, selling, storing and repairing motor vehicles was opened in Boston; an automotive show was held in Manhattan; a firm to buy and sell used motor cars was established in New York City.

These and other "firsts" in "the sport of automobiling," as it was then quaintly called, belong to the Northeastern States.

By 1940, the last full year of civilian automotive production, "the great tendencies" so acutely observed by the publisher had put on the highways of Connecticut, Massachusetts, New York, New Jersey and Pennsylvania some 7,373,339 motor vehicles, or 23 per cent of the total registered at that time in the United States.

Moreover, in the year before the war, these five states together comprised the second most important automotive industrial area in the nation. Here, activities connected with motor cars provided jobs for more than 1,500,000 persons.

In this "giant industry," which the publisher foresaw, the value of the durable goods produced for the automotive industry in these five states reached $522,760,000 annually. While, as the result of employment with vehicle, parts and tire manufacturers and petroleum refiners, some 97,618 workers were taking home pay checks aggregating more than $74,518,000 annually.

Sales, service and use of motor vehicles were also important peacetime sources of jobs for the men and women of the area. In 1940, approximately 1,396,320 persons, equal to the population of Nebraska, were employed in these activities.

Additional employment and wealth were created through the five states' 44,939 gasoline filling stations. Sales of petroleum products and similar commodities amounted to well over $592,300,000 in the last peacetime year, and provided a means of livelihood for 90,670 persons.

Taxes from the sale and use of motor vehicles annually constituted an important source of revenue for each of the states. Just prior to the war, the combined receipts from motor vehicle registrations, gasoline taxes and special motor carrier taxes amounted to $325,323,000, considerably more than the entire United States Customs' receipts for the year 1939.

When automotive production was halted following Pearl Harbor, 217 different plants in the five states were manufacturing or assembling motor cars, trucks and parts.

Today the men and women who made possible the impressive peacetime automotive activities in Connecticut, Massachusetts, New Jersey, New York and Pennsylvania are manufacturing a great variety of important war goods. The products rolling out of their plants range from tiny ball bearings to swift Navy fighter planes.

Former automotive plants in Pennsylvania, produce large quantities of half-tracs, scout cars, military cargo trucks, marine equipment, guns, ammunition, military cargo planes and parts for aircraft and motor vehicles.

In New York State peacetime builders of automotive equipment turn out machine guns, small arms, aircraft parts, and ball bearings.

Two plants in Connecticut are the nation's largest sources of ball bearings. In Massachusetts, former automotive equipment makers now produce fuel injection systems and magnetos for aircraft.

To produce the Navy's famed Grumman fighter planes, the facilities of five former automotive plants in New Jersey and Maryland have been combined. Delicate aircraft instruments come from another New Jersey town, while in hundreds of other cities, towns and villages up and down the Eastern Seaboard, parts and assemblies for the automotive industry are produced.

AUTOMOTIVE CHRONOLOGY, 1944

Production of aircraft and parts was the biggest automotive job in 1944.

JANUARY

10 Value of war goods produced in past 12 months totals $8,540,000,000, automotive industry announces.

14 Troop carrying glider, built by automotive woodworking plant, is given first flight test by company

21 Changing military strategy and shifting tides of battle have resulted in contract cancellations amounting to $2 000,000,000 in automotive industry

24 Automotive company announces 20 000th aircraft engine built for fighters, bombers and cargo planes.

FEBRUARY

2 Automotive parts manufacturer delivers 10,000 bomb sight computers.

10 Second anniversary of halting of civilian passenger car and truck production finds war deliveries of industry totaling $14,200,000,000

MARCH

5 Three thousand gyro-compasses produced by former manufacturer of motor vehicles.

12 More than 50 per cent of all spare parts used on one type four-engine bomber are supplied by a single automotive company

22 Production of new light tank, the M-24, started by automotive company.

28 Deliveries of liquid-cooled aircraft engines by one motor company reaches 50,000 figure

APRIL

11 Substantial price reduction in automotive produced equipment announced Cost of one type bomber cut 43% from original price, tank prices reduced 50%, machine guns down 61%

17 Navy receives Wildcat fighter plane No 2500 from automotive company.

28 Automotive company delivers $4,000,000,000 worth of war materials in first quarter of 1944, a 37 per cent increase over corresponding period one year ago.

MAY

13 Navy authorizes automotive company to announce production of folding wings for carrier-borne dive bombers.

17 More than 2,000,000 shells for 155 mm guns delivered by automotive firm.

20 Over 11,000 medium tanks and tank destroyers have rolled from assembly lines of one company to date.

26 Former passenger car manufacturer announces that deliveries of 14-cylinder aircraft engines passes 39,000 mark

27 Propeller production totals 100,000 at one company

JUNE

5 An automotive company produces the 100,000th six-cylinder Diesel engine for the Navy

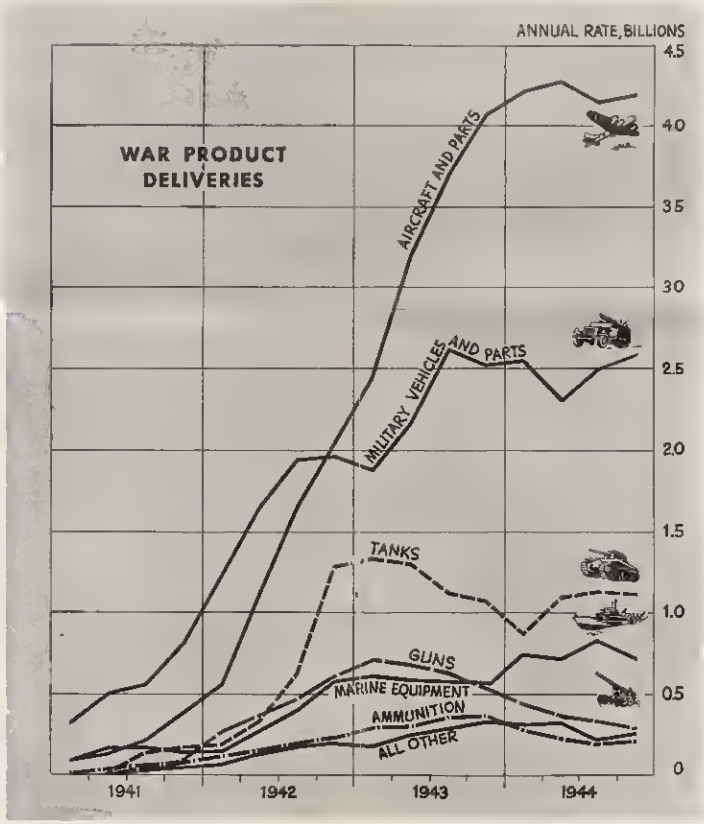
14 Dollar value of war goods delivered by automotive industry to armed forces totals $18,500,000,000 since start of World War II

Three billion 30 and 45 calibre bullets manufactured by automotive concern

22 A former automobile hardware plant turns out its 100,000th gyro-horizon indicator for the Air Forces

JULY

2 More than 50 000 aircraft engines delivered by former passenger car company.



Heavy trucks aid armies of liberation in push through Western Europe

6 Production of new type personnel and supply carrier, called the "Weasel," is announced by automotive company

7 Survey reveals 18,170 World War II veterans hired by automotive plants

10 Several former motor car manufacturers are permitted to reveal extensive participation in B-29 production program.

AUGUST

10 Deliveries to Armed Forces since start of war in 1939 by automotive industry top $20,000,000 000 mark

Responding to battle needs in Europe, automotive industry announces increased production of tanks, shells, heavy-duty trucks and aircraft engines.

22 Automotive company delivers 50,000th anti-aircraft cannon (20 mm) to Navy

SEPTEMBER

1 Automotive Council given American Trade Association Executives award for outstanding contribution to nation's war program.

10 Production of five new military vehicle types is revealed by automotive industry—motor gun carriage, armored combat car, tank destroyer, amphibious weasel, airborne tank.

OCTOBER

6 Automotive-produced helicopter is accepted by Army Air Forces

22 Automotive company announces production of robot bombs

31 Contract for manufacture of jet propulsion aircraft units taken on by automotive concern

NOVEMBER

10 Former passenger car builder ships 50,000th engine of a type used in PT boats and fighter planes

22 Production of 1,000,000th machine gun announced by automotive firm

DECEMBER

1 One automotive firm announces that its production of military trucks has now passed the 473,000 mark.

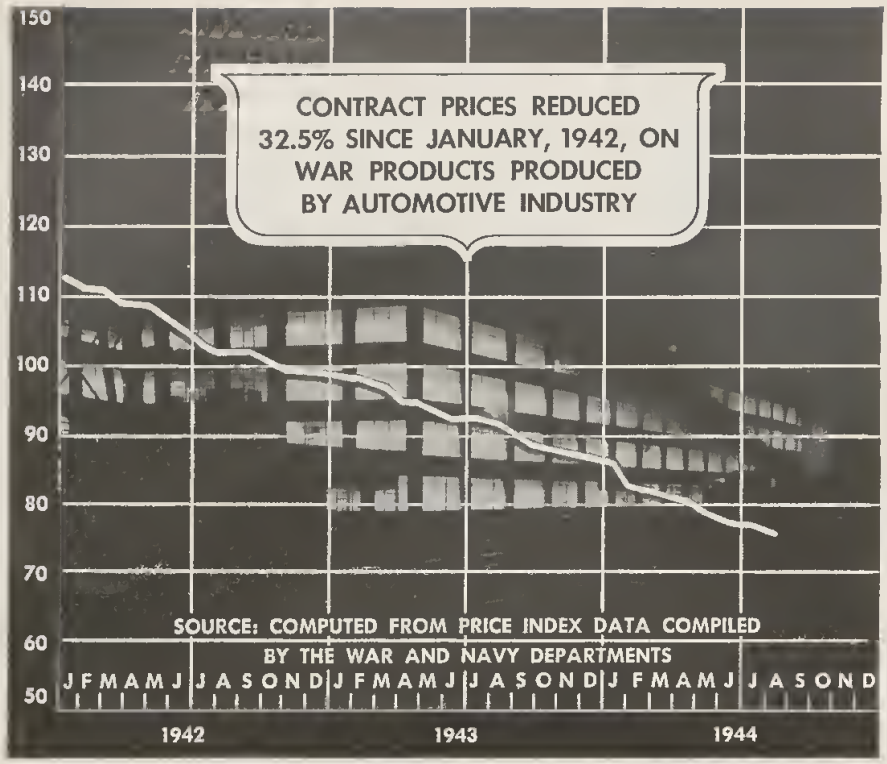
7 Central Aircraft Council's Engine Committee meets for 29th time since Pearl Harbor, discusses ways to step up B-29 production

Automotive company announces it has produced 7,000 four-engine bombers

8 Second automotive company begins production of robot bombs.

10 Automotive Council announces that contract prices dropped 32 5 per cent on automotive war goods in two years' time.

31 Automotive industry delivers $9,320,000,000 (estimated) of war goods in 1944 Annual production rate currently exceeds $10,000,000,000



Government Is Saved More than Three Billions As the Result of War Contract Efficiencies

To War Bond Purchasers: Do you know that each $18.75 invested in War Bonds today buys as much automotive-produced fighting equipment as $28 did two years ago?

War products from the motor industry are now acquired by the government at two-thirds the costs prevailing three years ago, figures recently developed by the Automotive Council for War Production reveal. Due to greater production efficiencies combined with improved product designs, costs of finished products have gone steadily down in the 32-month period between January, 1942, and August, 1944.

Price reductions range from a high of 55.8 per cent, for guns, to a low of 3.5 per cent, for tanks and other complex combat vehicles. Here are the figures as computed by the Automotive Council from a contract price index compiled by the War and Navy departments:

War Product	*Cost Reduction*
Guns	55.8%
Aircraft and components	36.5%
Ammunition	31.0%
Marine ..	31.0%
Tanks and combat vehicles	3.5%

Between the close of the first quarter in 1942 and the end of the third quarter this year, net cash savings to the government on automotive-produced war goods amounted to $3,111,000,000. Had prices remained unchanged during this period, war material produced by the industry in the third quarter of 1944 would have cost the government over $700,000,000 more than it actually did.

Illustrating price reductions made by the various companies in the industry, one former motor car manufacturer reports that an exhaustive cost study of 22 representative war contracts shows an average price decline of approximately 50 per cent during this period. At the same time, unit production of these items was nearly quadrupled.

Another company, a major producer of medium tanks, estimates that since it began turning out these combat vehicles, more than $60,000,000 has been saved the government as the result of various manufacturing economies, efficiencies and cost reductions.

Chart does not reflect additional reductions in costs to the government resulting from voluntary lump sum refunds by contractors, nor over-all lump sum reductions resulting from renegotiations by the Price Adjustment Boards.

Automotive Gun Plant Changed to Shell Work

Industry Responds to Demands from Front

As Allied armies in western Europe unleash their winter drive to knock Germany from the war, and American doughboys start along "the road back" in the Philippines, production of war goods in the automotive industry is being stepped up all along the line.

Recent months have seen the motor car industry called upon to increase tank deliveries by one and one-half times the number delivered prior to European D-Day. The production rates of certain fighter plane engines and power plants for B-29 Superfortresses is steadily increasing. Heavy-duty trucks are another top priority item on the industry's delivery lists. One plant has been asked to produce 40 per cent more Bofors anti-aircraft guns. Another company has halted production of giant "stratosphere" anti-aircraft cannons and has begun volume production of 155 mm artillery shells.

To meet the demands for more of these shells, the automotive company which tackled the job had to undergo a major plant reconversion. Four months were needed to make the necessary changes.

Approximately 25 per cent of the plant's floor space was cleared of unusable gun-production machinery. Specially-designed and built equipment, including huge heat-treat furnaces and a system of automotive-type conveyors were installed. Among the ingenious pieces of productive equipment set up by the plant engineers was a powerful 350-ton press which shapes the noses of the shells in one stroke.

AUTOMOTIVE
WAR PRODUCTION

Published by

WAR PRODUCTION INFORMATION
DEPARTMENT

Automotive Council
for War Production

GEORGE H. CUSHING, Editor

New Center Building, Detroit 2, Michigan

WAR ON WHEELS

Versatile Vehicles

AMERICAN fighting men and production experts have learned during three years of war that military vehicles are capable of successfully performing many tasks never visioned originally by designers. The accompanying photographs reveal that resourceful, inventive GIs and factory men alike often improvise or adapt equipment to enable it to undertake many extraordinary tasks.

Right: Designed as weapon carriers, one-half ton trucks in Karachi, India, tow partially-assembled P-47 fighter planes along a 15-mile route from transport ships to airbase. Left Center: To scrape roads, push through hedgerows, bury enemy pillboxes while under heavy attack, General Sherman tanks are often fitted with bulldozer blades. Center: Two Ducks, primarily built to transport troops and supplies in amphibious operations, form a catamaran for ferrying full-assembled aircraft from ship to shore. Right Center: Standard 30-ton tank chassis have been equipped with powerful 155 mm "Long-Tom" cannons to give Allied troops superior mobile artillery support. Bottom: The potent "Smoke-Drakes" are Ducks in a new battle-dress. Fitted with M-1 mechanical smoke generators, each is able to spread enough thick, white fog in 10 minutes to blot out a square mile.

Automotive companies' text books hove gained world-wide circulation.

Technical Books Published by Motor Companies Help Armed Forces Develop Training Programs

NOT only is the automotive industry the country's largest mass-producer of weapons for the armed forces, but it has become a publisher and distributor of war books on a scale which compares favorably with the circulation attained by many current "best-sellers."

While none of the automotive-published books may ever win nominations as books-of-the-month, they are required reading for thousands of officers and enlisted personnel in the armed forces. They detail the established military procedures for repairing, overhauling and reconditioning complex military equipment.

Virtually all automotive companies, including many automotive-parts firms, participate in this wartime publishing enterprise. The need for detailed instruction manuals presented itself almost as soon as the industry began producing new and highly-complicated war materials so essential to victory.

FILES ARE NOT PRY BARS

At that time the armed forces, faced with the necessity for training large numbers of men in the intricacies of servicing modern military equipment, asked the industry to tackle the job as one more war project. Written in easily understandable language, profusely illustrated, the books follow a format developed by the armed forces.

In addition to maintenance and instruction books, the industry prepares and distributes detailed parts catalogues for each war product it manufactures, booklets on the proper use of ordinary hand tools, descriptions of internal combustion engines, and a host of other publications covering automotive subjects.

NEVER DO THIS

With the publishing output running into millions, circulation of the books has attained phenomenal proportions. Regular publishers consider they have a sensational success on their hands when a popular book, such as a diary written by a famous war correspondent, reaches a circulation mark of half-a-million. Yet, in a few short months, two automotive-published books have exceeded this figure.

The two books to pass the 500,000 mark are, "Hand Tools, Their Correct Usage and Care" and "Power Primer, An Introduction to the Internal Combustion Engine."

In addition to overseas shipment, 10,000 copies of the hand tool publication were sent to the United States Military Academy, and 5,000 copies were distributed to Canadian troops. Great Britain also asked for and received reprint rights.

Issued more recently, the "Power Primer" has received similar world-wide distribution. Special requests number over 30,000, and some 10,000 copies were also sent to West Point.

Another unique book, "Handbook of Motor Vehicles Used by the United States Armed Forces," designed to give fighting men a clearer idea of the engineering features of American military vehicles, has gone to over 25,000 American service men. In addition, the British Ministry of Supply recently requested a large number of copies for distribution to Empire troops.

HAMMER HANDLE SHOULD ALWAYS FIT HEAD TIGHTLY

National Safety Mark Set by Motor Plants

DESPITE the addition of thousands of new employes, many of whom never worked in factories before the war, the automotive industry has established one of the nation's outstanding industrial safety marks.

A recent country-wide survey shows the average injury rate and number of days lost from work as the result of accidents in automotive plants to be approximately 30 per cent and 48 per cent lower, respectively, than the average for all United States industries.

The tabulation reports an average of 10.26 disabling injuries per 1,000,000 man-hours worked in the automotive industry as against a 14.52 average for all industry. Accidents caused workers in motor plants to lose an average of .63 of a day per 1,000 man-hours worked, compared with a national industrial average of 1.20 days.

1944 INDEX JANUARY THROUGH DECEMBER

AUTOMOTIVE WAR PRODUCTION

Automotive Council for War Production

THE following index to Volume 3 of AUTOMOTIVE WAR PRODUCTION lists alphabetically and by cross-reference the subjects treated in the issues of January through December, 1944.

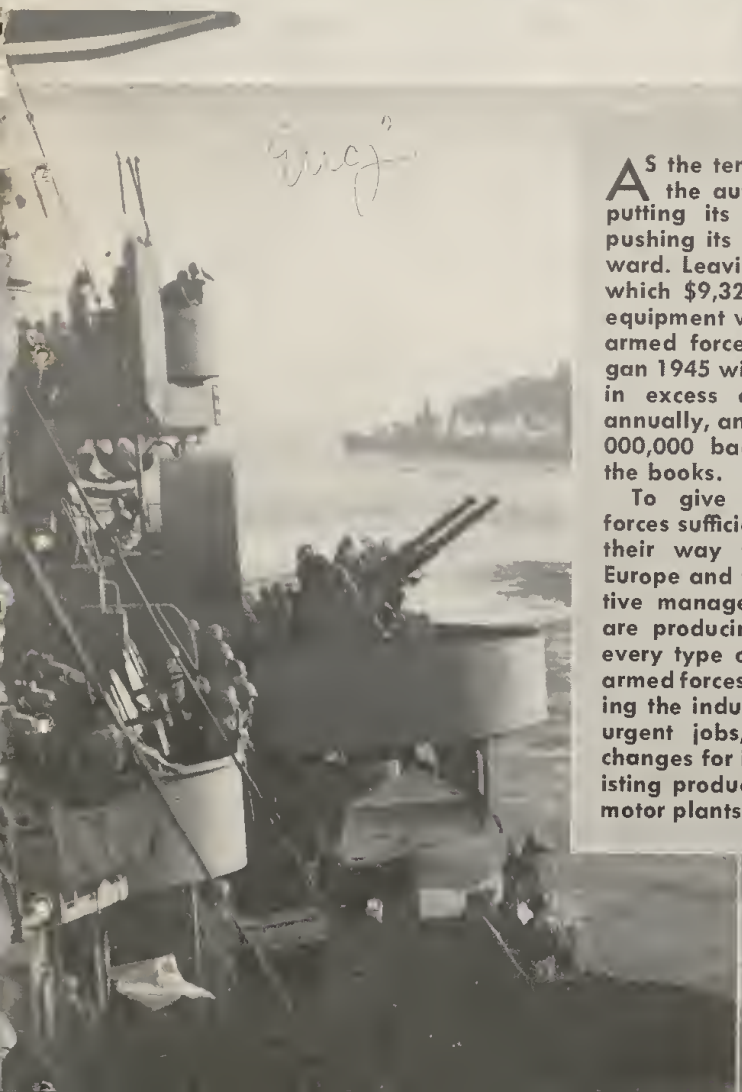
NEW CENTER BUILDING, DETROIT 2, MICHIGAN

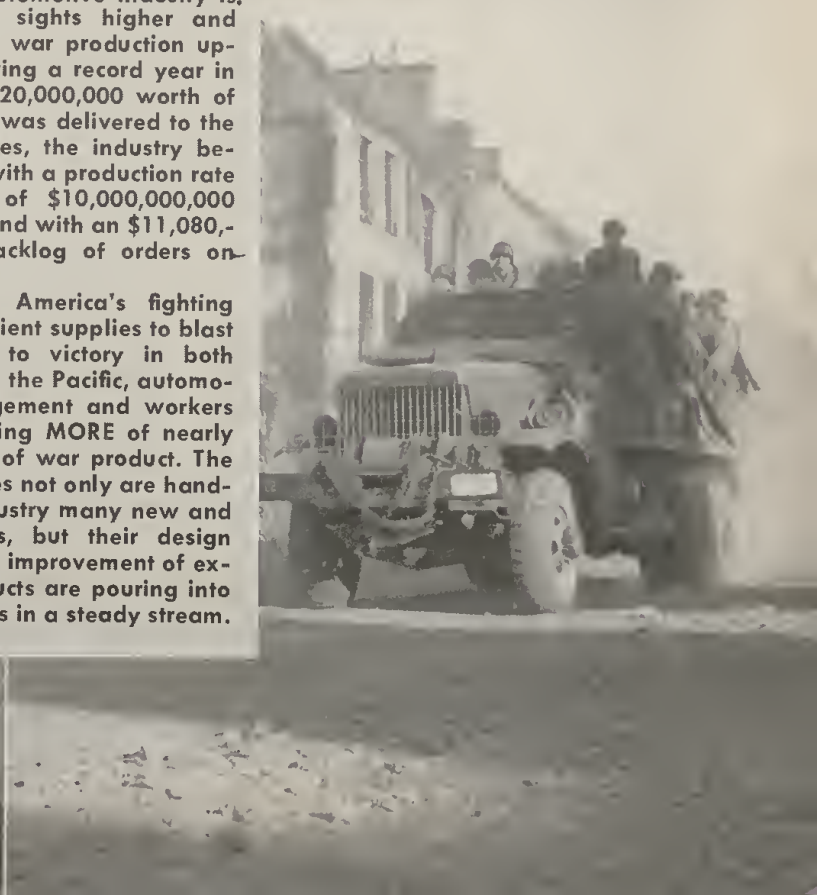
AUTOMOTIVE WAR PRODUCTION

Vol. IV No. 1 | Published by Automotive Council for War Production | February, 1945

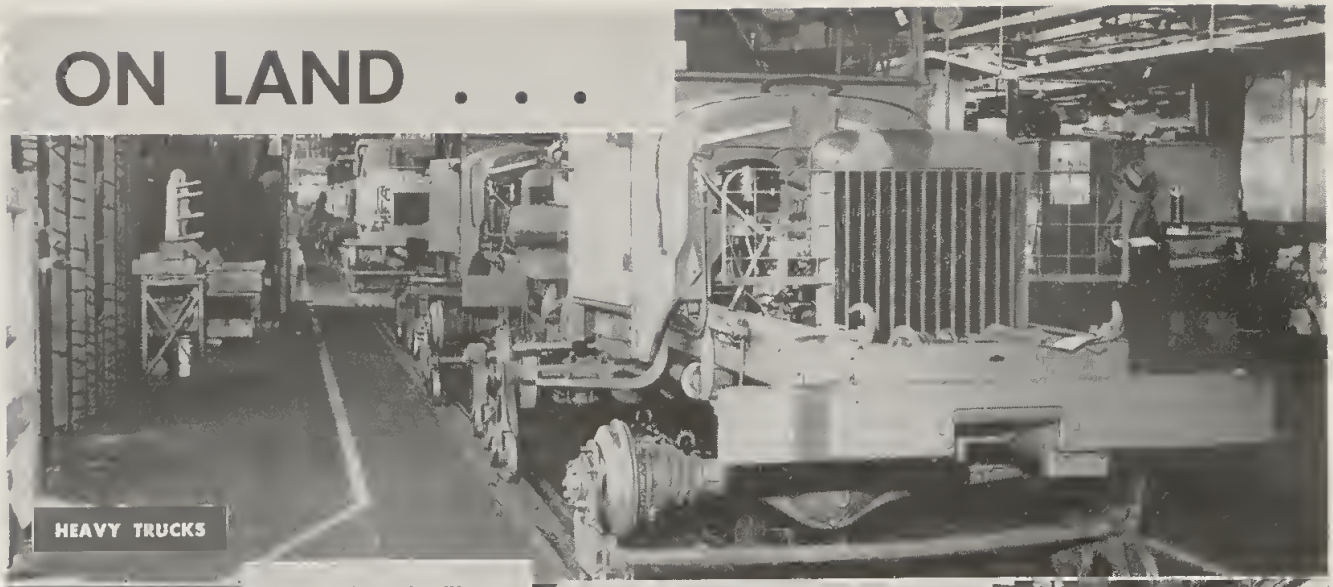
AS the tempo of war mounts, the automotive industry is putting its sights higher and pushing its war production upward. Leaving a record year in which $9,320,000,000 worth of equipment was delivered to the armed forces, the industry began 1945 with a production rate in excess of $10,000,000,000 annually, and with an $11,080,000,000 backlog of orders on the books.

To give America's fighting forces sufficient supplies to blast their way to victory in both Europe and the Pacific, automotive management and workers are producing MORE of nearly every type of war product. The armed forces not only are handing the industry many new and urgent jobs, but their design changes for improvement of existing products are pouring into motor plants in a steady stream.





ON LAND . . .

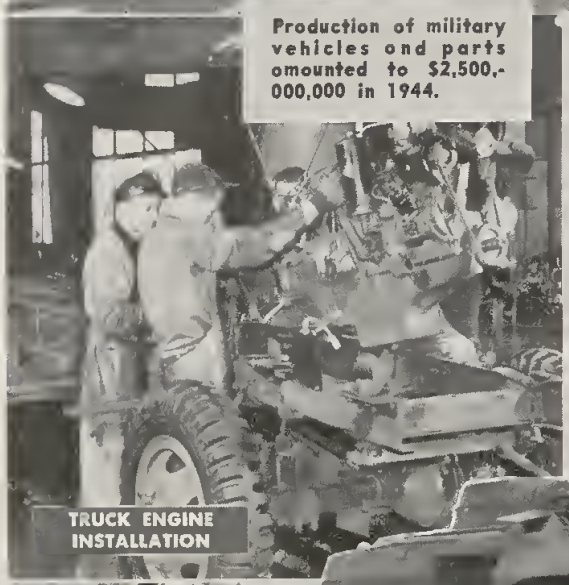


HEAVY TRUCKS

Production of military vehicles and parts amounted to $2,500,000,000 in 1944.

DESPITE threatened shortages in skilled labor, purchased components and facilities, automotive companies expect to meet or exceed increased schedules for trucks, tanks and new types of armored combat equipment in 1945.

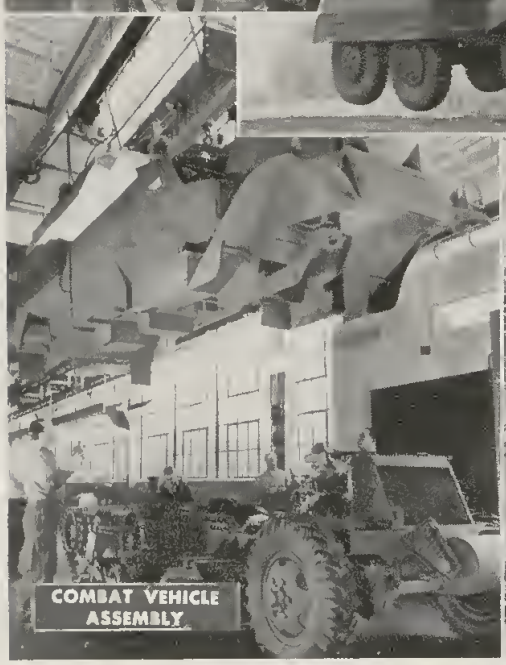
Overall heavy truck deliveries have been set at 6,700 monthly for 1945's first quarter, including a 58% and a 71% increase for six- and four-ton vehicles, respectively. Tank goals have been boosted from 1200 to 2000 units a month for the industry.



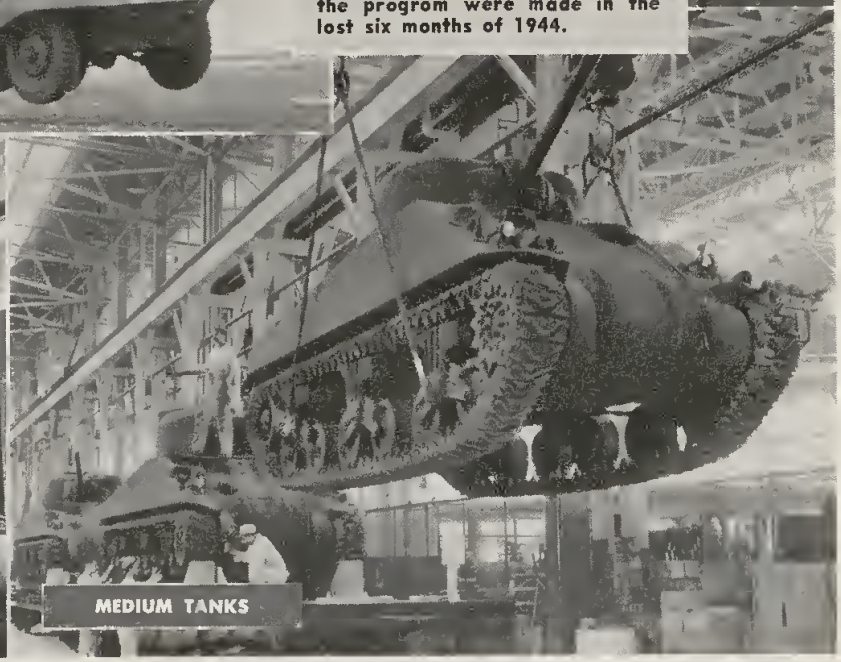
TRUCK ENGINE INSTALLATION

TANK TURRETS

Approximately 22% of all tank deliveries since the beginning of the program were made in the last six months of 1944.



COMBAT VEHICLE ASSEMBLY

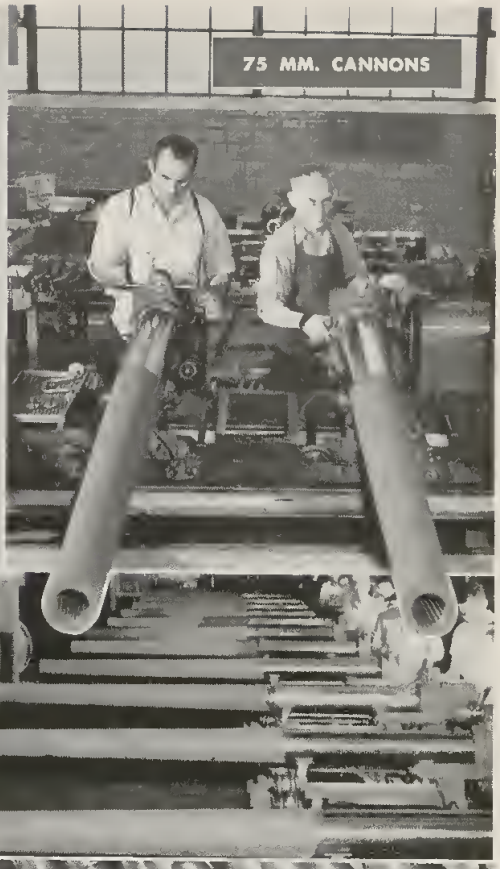


MEDIUM TANKS

DIESEL TANK ENGINES

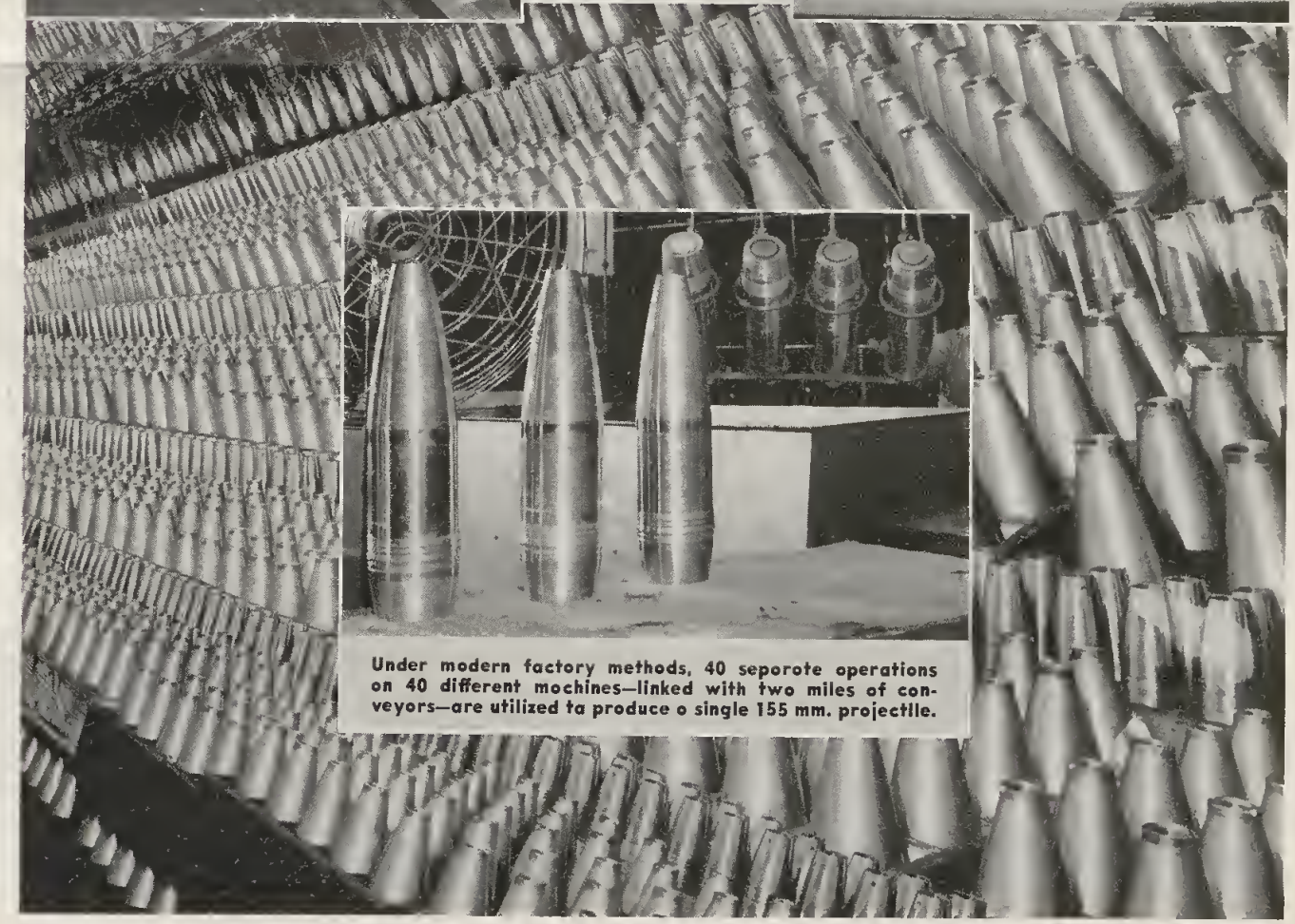
THE army's supply of heavy firepower will in large degree help to hald dawn the number af casualties among U.S. infantrymen in the campaigns to came. Currently, autamative plants are supplying 76 mm. tank artillery pieces, maunts far big guns, cradles and yakes for 155 mm. guns, sights far trench martars, and six types af shells.

In respanse ta recent demands far big shells, one campany is daubling its autput, a secand expects ta attain a 150% increase by February.



75 MM. CANNONS

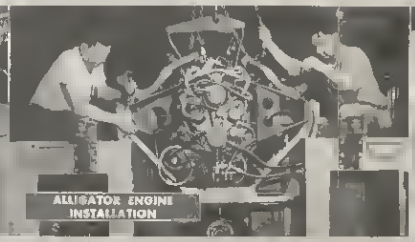
In 1944 automotive plants praduced their 4,700,000th gun, Products whose manufacturing processes are totally unlike those used for peacetime goods, these weapons ranged from caliber .30 carbines to 120 mm. stratosphere cannon.



Under modern factory methods, 40 separate operations on 40 different machines—linked with two miles of conveyors—are utilized ta produce a single 155 mm. projectile.

ON THE SEA . . .


ALLIGATOR PRODUCTION


ALLIGATOR ENGINE INSTALLATION


PT BOAT ENGINE


ANTI-AIRCRAFT GUN


SEA MULE PRODUCTION

THE road to Tokyo is still a long one, although the broadening of naval operations during 1944 brought American troops, planes and big guns closer to the heart of the Japanese Empire.

Like the rapidly changing European war, action in the Pacific has introduced unpredictable needs for increased deliveries of certain types of weapons. Example: more Alligators to give invading troops armored protection, both between transport ship and shore, and on land. To fulfill its doubled requirements, the automotive company which produces a large share of these vehicles has expanded manufacturing facilities and installed new assembly lines.

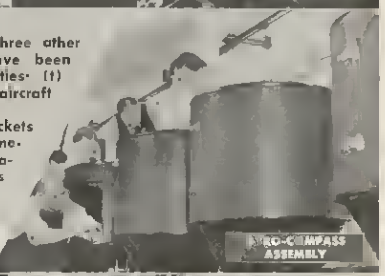
Last year, the automotive industry was called upon to increase its production of specialized amphibious weapons. Dollar value of marine equipment deliveries increased 20% over the preceding year, and peak production was attained on all types, ranging from Alligators to troop and cargo-carrying Ducks, Weasels and Sea Mules.

Bofors anti-aircraft guns for combat vessels and huge Diesel engines for submarines and landing craft emphasize the diversity of the motor industry's war production. Two automotive companies alone have produced 104,000 engines.

In Naval ordnance, three other automotive programs have been accorded top 1945 priorities: (1) rockets, (2) 40 mm. anti-aircraft guns, and (3) spare parts.

Among all Navy programs, rockets are the most urgent on the automotive industry's docket. Current national production of these missiles is eight times that of the first quarter of 1944, but output must be tripled again to meet this year's third quarter requirements.

The need for Bofors anti-aircraft guns, used on fighting ships and larger size landing craft, has increased tremendously. Schedules have been upped 40% since last June, and further upward revisions are in prospect during 1945.


GYRO-COMPASS ASSEMBLY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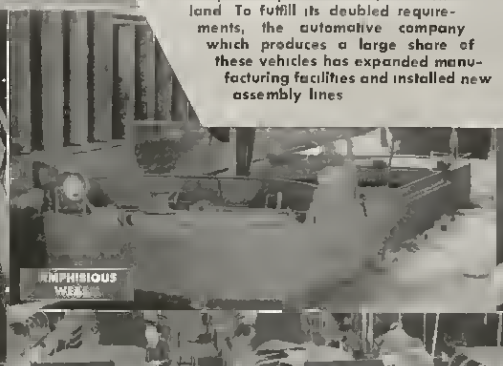
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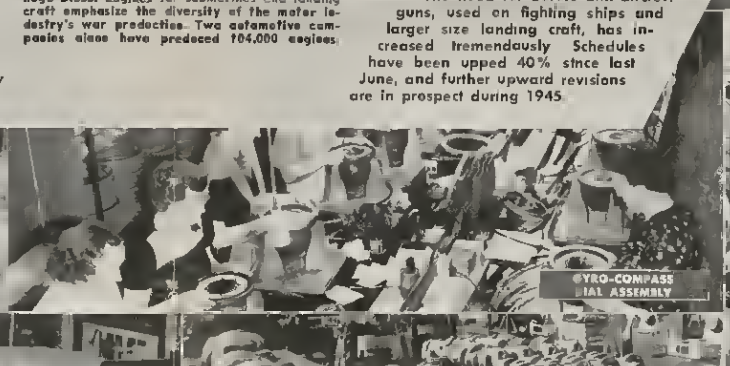
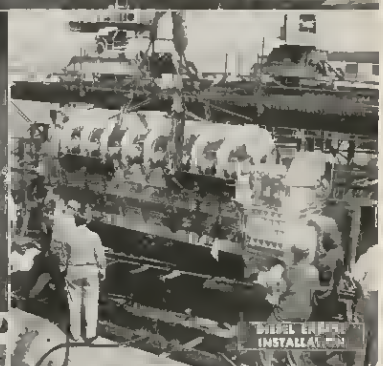

GYRO-COMPASS [illegible]IAL ASSEMBLY


DIESEL ENGINE INSTALLATION

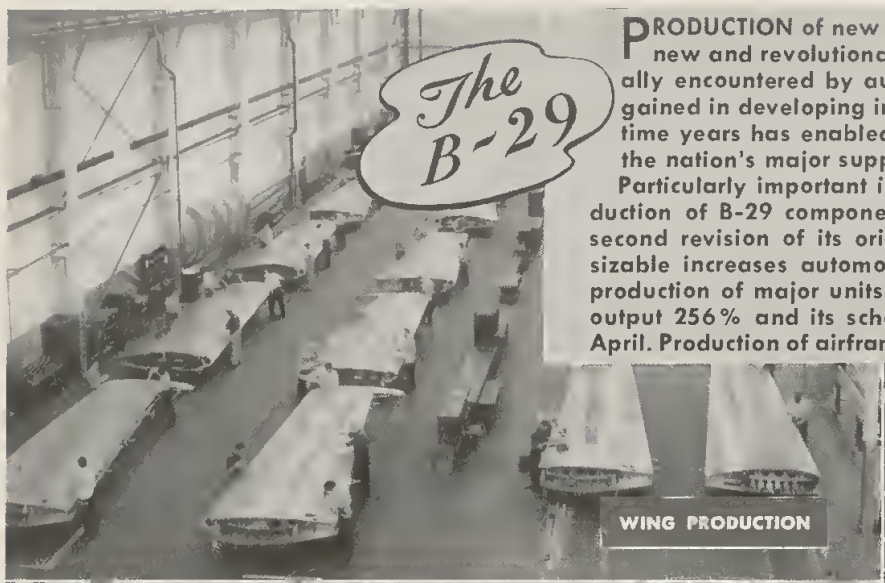

DUCK PRODUCTION


DIESEL ENGINE CRANKSHAFTS

The B-29

PRODUCTION of new and revolutionary designs, requiring new and revolutionary techniques, is a problem continually encountered by automotive engineers. But experience gained in developing improved processes during 40 peacetime years has enabled the industry to become in wartime the nation's major supplier of certain types of aircraft.

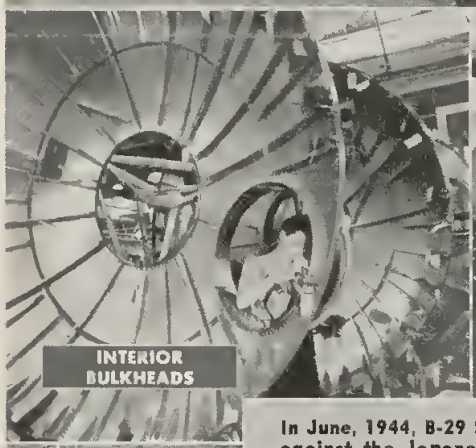
Particularly important in the industry's program is the production of B-29 components. The Air Force has just made a second revision of its original schedules, and to meet these sizable increases automotive plants are rapidly building up production of major units. One company has boosted engine output 256% and its schedule calls for a 365% increase by April. Production of airframes has been revised upward 160%.



WING PRODUCTION

WING ASSEMBLY

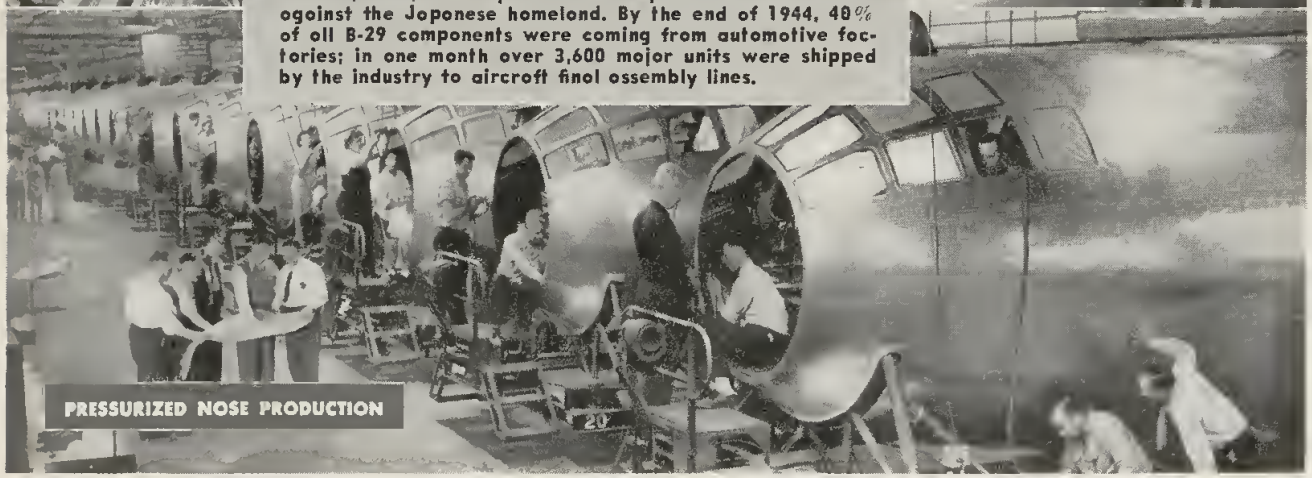
VERTICAL FIN



INTERIOR BULKHEADS

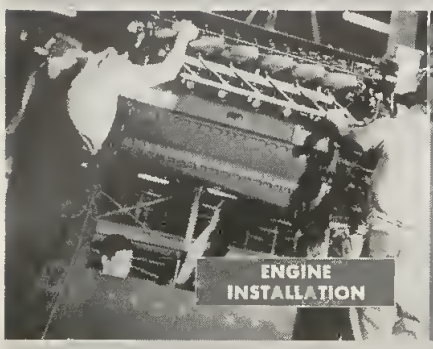
ENGINE COWLINGS

In June, 1944, B-29 Superfortresses opened the air offensive against the Japanese homeland. By the end of 1944, 40% of all B-29 components were coming from automotive factories; in one month over 3,600 major units were shipped by the industry to aircraft final assembly lines.

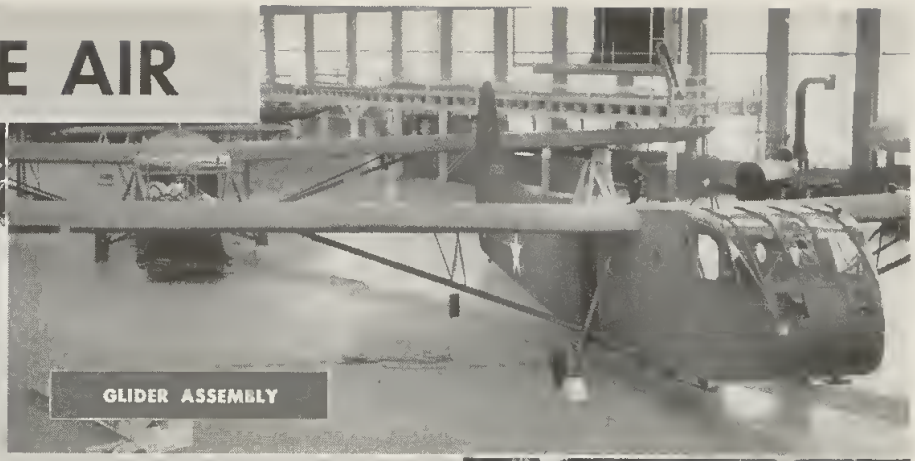


PRESSURIZED NOSE PRODUCTION

. . . IN THE AIR



ENGINE INSTALLATION



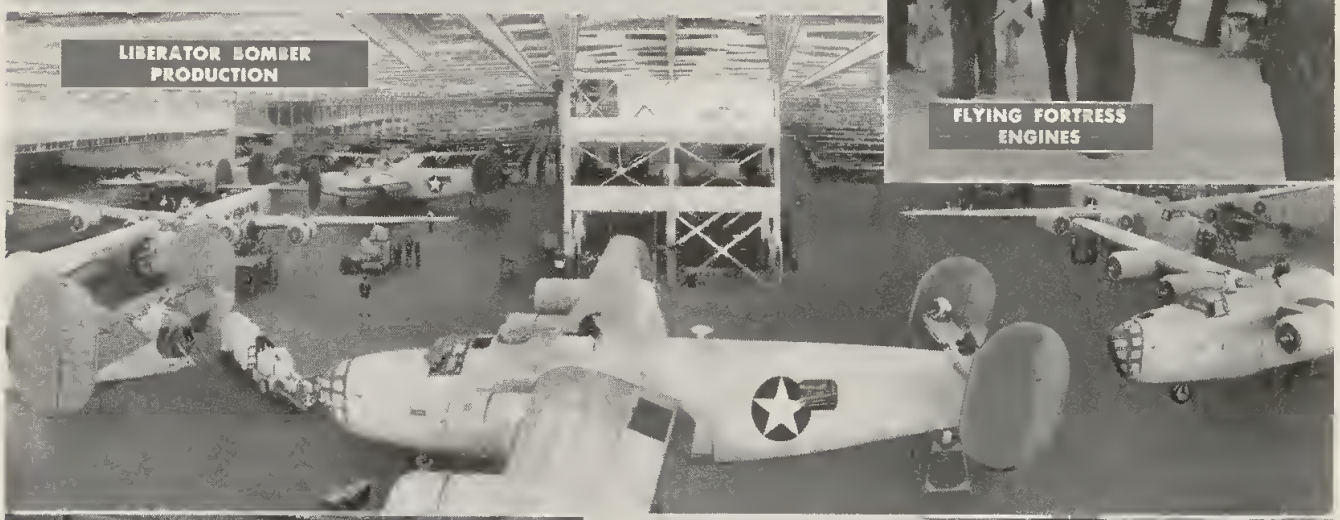
GLIDER ASSEMBLY

WITH 1945 destined to be a year of offensive action for America and her allies, production schedules for other important aircraft and sub-assemblies hove been set by the military at new high levels.

The revised program calls for o four per cent increase of all types of planes, with actual unit deliveries set for 78,227. Fighter planes reflect the bulk of the increase, although the production schedule for B-24 bombers also hos reversed a trend and is currently on the upswing.

Component parts and such specialized aircraft as gliders, have olso been affected by recent chonges. Propeller output for example, hos been raised 384%, with peak production to be ottained by March.

FLYING FORTRESS ENGINES

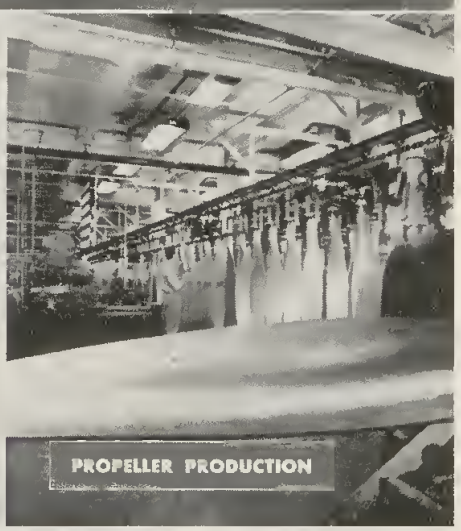


LIBERATOR BOMBER PRODUCTION

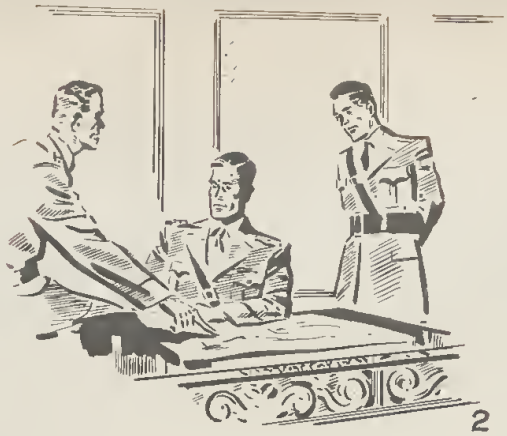
FIGHTER PLANE ENGINES

Monufocture of oircroft ond ports held top spot in the motor industry's wor progrom during 1944, with production volued ot $4,200,000,000. Peok production wos ottoined in the lost holf of the yeor, when deliveries omounted to 25% of oll oircroft ond ports produced by the industry since 1940.

These representotive production occomplishments indicote the scope of the industry's oircroft contributions to dote: 81% of oll gliders; 43% of oll propellers; 54% of oll Liberotor bomber production.



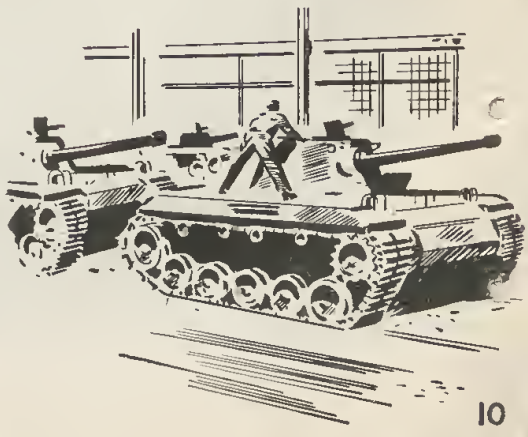
PROPELLER PRODUCTION



THREE YEARS OF WAR, which daily found American armed forces meeting new problems of climate, terrain, and natural and man-made obstacles, have strengthened the chain of inter-dependence between the fighting front and the production line. The smoothness and facility of this teamwork between industry and the military services, determining the speed with which battlefront needs are translated into the production of new or revised weapons, governs much of the success of Allied military undertakings.

For example, American tanks may hang up an excellent battle record while operating (1) under the conditions for which they were originally designed; but military men in laying out long-range plans for future large-scale operations may decide that these same vehicles (2) must be radically changed in design to be effective in the forthcoming campaigns. After the new specifications have been established and exact limits of performance determined, the problem is referred to a production source in industry (3) which is charged with the preparation of a design for production. Once the new design is approved, industrial process engineers (4) plan, step by step, the work to be done to get the new weapon made, and after tool engineers developed the necessary mechanical aids, scheduling men (5) keep a close check on the progress of the equipment on order in tool-making plants.

Next, the plant layout specialists (6) spot each machine in its proper place on the production line in accordance with best manufacturing practices. When this is completed, actual retooling and resetting of production machines (7) takes place, and soon the first pilot model (8) is ready for inspection and rigorous testing (9) at the proving grounds. Finally, after the revised product has undergone all military tests and received approval, mass production (10) begins, and an uninterrupted flow of weapons designed to meet the military need is on its way to the front.



Automotive WAR PRODUCTION

Vol. IV No. 2 Published by Automotive Council for War Production March, 1945

More War Goods Produced With Automotive Methods

Industry's Efficiency Stepped-Up By Improved Tooling Techniques

DESPITE the huge influx of new and inexperienced workers, the automotive industry in the past year and a half has been able to step up its production efficiency until deliveries of fighting equipment have reached a record $10,000,000,000-a-year rate.

This improved efficiency results from better machine methods, ironing out bottlenecks caused by lack of critical production tools and scarcities of materials, and the overcoming of many other initial production handicaps.

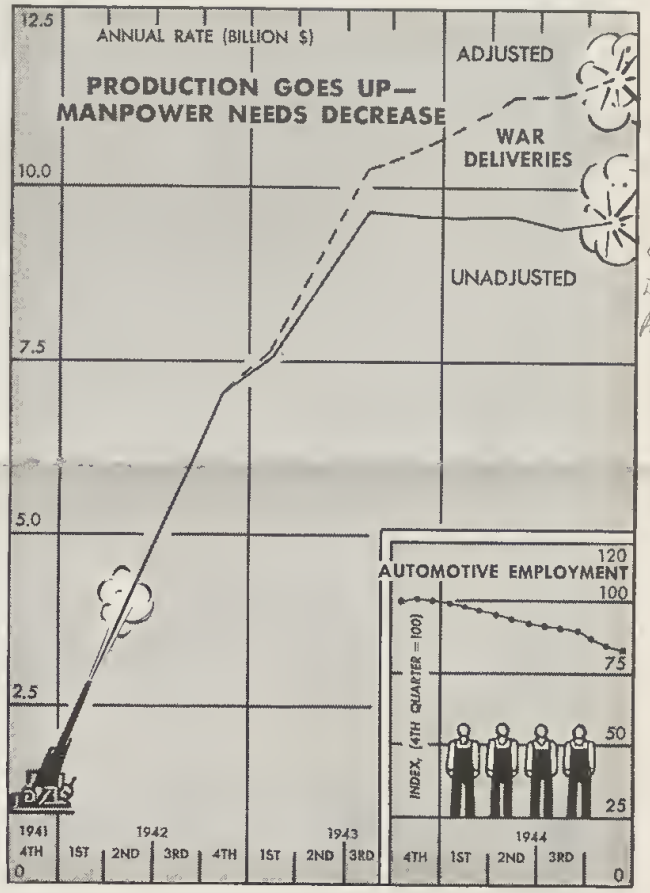
As a result of these continuing improvements in the industry's mass production techniques, the actual quantity of manpower needed to sustain this volume has shown a small but steady monthly decline in the last year.

Between the fourth quarter of 1943, when automotive employment reached an all-time high, and the corresponding quarter in 1944, deliveries of war materials to the armed forces rose approximately 11 per cent. During the same period employment dropped some 16 per cent.

By the close of 1943, the great bulk of the tooling for war production had been completed, two full years of experience had been accumulated on once untried products, and the slender flow of parts and materials from suppliers had become a steady stream, pouring into assembly plants from nearly every state in the nation.

When the industry entered the current year, war production had reached totals not even adequately reflected by the huge $9,300,000,000 dollar-volume figure, itself a tenfold increase over 1941's defense production. The actual physical volume of deliveries was appreciably larger than the production figures indicate because of voluntary price reductions which enabled the government to acquire war products at two-thirds the cost prevailing three years ago.

Included in the production and delivery of this vast total of war materials are millions of units of combat equipment. Some 3,392,000 engines for military trucks (2,775,000), aircraft (345,000), marine (148,000) and tanks (124,000) have been produced since the start of the industry's war program. Military truck and tank production amounted to 2,387,000 units, made up of 2,220,000 trucks, 41,800 land and amphibious tanks and 126,000 gun carriages and armored cars. Gun units manufactured total 4,741,000, comprised of 2,700,000 carbines and rifles,



Actual dollar deliveries, including price reductions, are shown by the solid line. Had prices remained unchanged since the fourth quarter of 1942, however, the industry's output would follow the broken line, which gives a more accurate reflection of the physical volume of war work performed.

1,260,000 machine guns, 144,000 anti-aircraft weapons and 637,000 other types.

Today, as demand for weapons increases with each new military move, the industry's output continues to rise. New orders pour in for rockets, bomber planes, bombsights, high-powered aircraft engines and shells. In one manufacturing center, $750,000,000 of new contracts have been placed with motor plants alone since the first of January.

The weapons of war, far more complicated to build than peacetime cars and trucks, now have been fitted into the automotive industry's mass production pattern successfully. By this time even contract cancellations, cutbacks and continuous design changes have been encountered often enough so that handling them does not cause major disruption of the day-to-day outpouring from automotive plants.

Rehabilitation Programs Enable Handicapped To Fill Essential Jobs in Automotive Plants

Parts for aircraft engines are assembled by a blind automotive worker.

SIX DAYS a week, fifty-two weeks a year, a sightless man and his Leader dog step confidently from a public conveyance and pass through the guarded entrance of a large automotive war plant.

Gently tugging at the leash, the dog guides his blind master down long aisles, through the maze of busy machinery singing the high C of war production, skillfully avoiding obstacles and other workers hurrying to or from urgent jobs.

In a department where handicapped and ordinary persons work side by side, the blind man takes his place at a bench and begins sorting and fitting together small parts which ultimately go into aircraft engines. Under the bench on an especially built resting place, the dog lies quietly until commanded to escort his master to another part of the plant, or to retrace his steps at the close of the day.

Injured several years ago, the worker is one of thousands of physically handicapped persons who have carried on in spite of their afflictions and have been successfully fitted into worthwhile jobs in the automotive industry. Among others who have found useful, prideful and gainful work in the industry are deaf mutes, diabetics and people who have lost limbs.

In the eyes of automotive industry rehabilitation experts there are no "disabled men," and no jobs are "created" for the handicapped. For example, persons who have lost a foot, a leg or both legs are given a sitting down job; those with a hand or an arm missing are placed on jobs operated with one hand; men who have lost both hands or arms are put on machines operated by foot; the sightless perform operations where touch and practice are the chief requirements.

At one automotive parts company a 24-year-old blind man edits a bimonthly newspaper for employes. With the aid of a Leader dog he roams the plant and digs up articles for the publication. He writes the stories, reads proofs by feeling the type with his fingertips and designs the pages.

For 20 years another company, with facilities in several widely scattered communities, has hired persons with physical shortcomings in proportion to the population in the plant cities. Altogether, some 11,300 handicapped or physically limited workers are on the company's payrolls.

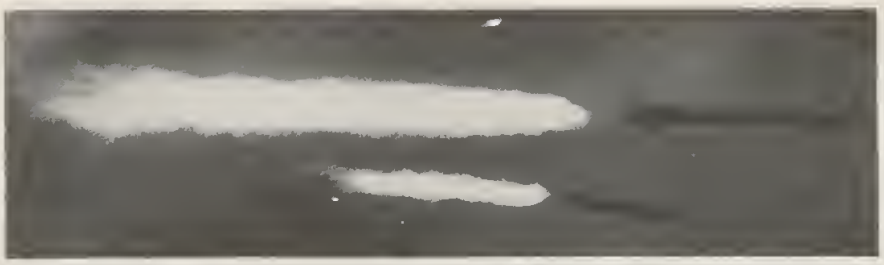
In this group, 687 are sightless in some degree, including 40 who are totally blind; many can only distinguish between light and dark; a few see motion if it occurs between them and the light. Sixty-six are deaf mutes; 80 have lost one arm; 12 have lost both arms; 91 have one leg amputated and 10 are legless. In addition, 31 have lost the use of some part of their bodies because of spine fractures.

The totals of handicapped workers employed in the automotive industry have only recently begun to reflect the discharges being given to wounded veterans of World War II. Automotive companies generally, however, are studying their procedures for employing the handicapped with an eye to their own workers now in the services; preparations for the job placement of those who may return partly disabled are already being made.

Cigarettes Hard to Get? Motor Plants Help Out

RECENTLY, two motor firms developed programs for the equitable distribution of their limited cigarette supplies. Instead of placing a few packages on sale daily at lunch wagons, in cafeterias and candy stores, both companies hold up incoming shipments and designate a regular day as "Cigarette Day." Meantime, coupons, good for a pack, are issued with paychecks.

While the principle of distribution is the same for both companies, the plans vary slightly in operation. One company accumulates a supply sufficient for 85 per cent of its workers and makes weekly sales. The other holds back its sales until at least one package for each employe has been acquired.



Automotive Firms Convert Production Lines To Meet Stepped-Up Demands for Navy Rockets

TO SEND HOT DEATH with a fiery tail streaking through the sky toward an enemy, you must first obtain a piece of metal tubing. Then cut threads in one end of it, weld on launching buttons and attach four guide vanes to form a tail. Next, insert the power expulsion cap in the hollow tail end, add the explosive and the war head, and you will have a rocket to do the job.

Now one of the most vitally needed war weapons, rocket production has been vastly stepped up with quotas for the Navy alone boosted 300 per cent over 1944 as orders for $1,000,000,000 worth of these projectiles fanned out across the country. Responsibility for a large share of this volume rests on the automotive industry, with $156,000,000 in rocket orders assigned to 17 prime contractors and 800 subcontractors in one automotive producing center.

To fill tremendous requirements for a 2¼-inch practice rocket designed for pilot training, the Navy had previously turned to an automotive company which in peacetime specialized in the production of light-weight cars and delivery trucks. Since widespread pilot training must precede broad use of a new air weapon, production quotas running into six figures monthly were set, and the company, then manufacturing torpedo engines, was asked to take on a job calling for high speed conversion.

While the company was finishing the contract for torpedo engines, the rocket job requirements were studied by production and tooling experts and broken down into 25 simple operational steps. The production line was planned and charted, the required equipment designed and ordered. Subcontracts were let to suppliers, pilot models were built and tested, and the plant was made ready to wade into the new contract without loss of time.

Testing equipment to control quality was designed by the automotive engineers in advance, and when orders for it could not be filled in time, the company's machinists "rolled their own" out of miscellaneous parts of other machinery, old angle irons, pressure gages, and the like. One such testing apparatus forces pressure inside the hollow center of the rocket, to make certain that it will sustain the pressure of 500 lbs. per square inch exerted by the combustibles which discharge the projectile toward the objective.

As the last torpedo engine progressed through the plant, workmen tore out the old assembly line and moved in rocket production equipment. Although much substitute machinery had to be utilized, full-scale production was achieved in only thirty days.

Victory Shift Helps Plant Top Schedules

Townspeople Pitch In To Produce Rockets

"PLEASE pass the rockets, Mrs. Jones!"

This is the theme of a patriotic group of citizens in a medium-sized eastern community who spend their "after hours" working in an automotive war plant.

Composed of housewives, widows living on pensions, retired workers, farmers who till their fields all day, retail store proprietors and clerks, the group turns out aircraft rockets for the Navy from six to eleven every night, supplementing the production of two regular day shifts.

Situated in a rural area containing a limited number of industrial workers, the company found its employment quotas depended upon simplifying the production method to make it possible for any man or woman to learn a job within a day or two.

The "Victory Shift" was the answer. Its success enabled the company to report that schedules for rocket production, in six-figure quantities, were being met in the second month of operations.

Rackets ta blast Tokya are laaded in a fighter plane by Navy crewmen.

Throughout the war intercity buses have tackled many special assignments.

Intercity Buses Handle Majority of Travelers Despite Acute Wartime Operating Limitations

IMAGINE, if you will, that this is the year 1827, and business makes it necessary for you to travel between the Virginia Seaboard and the Ohio Valley, a journey of approximately 400 miles.

You board a "shakeguts"—a springless, high-wheeled stage coach—and set out over the newly-opened James River and Kanawha Turnpike. Often, during the four-and-a-half-day journey across the 3600-foot high Allegheny mountains, you and your seven fellow passengers are compelled to get out of the coach and help the driver extricate horses and stage from a soft marshy patch or a deep pothole in the rough and rutted road.

Today, even under wartime driving limitations, you can make the same trip in around 18 hours, and you'll travel over a smooth, broad highway in a luxurious 32-passenger motor coach.

Since those pioneer days, some three million miles of public highways have replaced the rugged wilderness trails of early America, and traveling these modern roadways are 21,500 intercity motor buses which maintain daily schedules between the largest cities and the smallest hamlets. In the last three-and-a-quarter years, the nation's fleet of buses has annually carried more than one-half of all the persons transported by intercity public carriers.

Despite such wartime difficulties as acute shortages of replacement vehicles, repair parts, skilled manpower, and severe restrictions on the use of gasoline and tires, buses have more than doubled their passenger-miles since Pearl Harbor.

In one recent 12-month period, an estimated 692-million persons, nearly five and one-half times the population of the United States and 75 per cent more passengers than ever traveled in any peacetime year, rode in the nation's motor coaches. Most of this travel has been classified by the United States Department of Commerce as essential to the country's war effort, some 32.5 per cent representing urgent business or military travel, and 48 per cent being necessary civilian movement, with only 19.5 per cent attributable to pleasure or recreational travel.

Along with their stepped-up highway travel job, intercity buses have been handed many special wartime assignments. Periodically, in all sections of the country, large fleets of motor coaches have been mobilized for emergency military movements. A majority of the military selectees have been transported from home towns to induction stations by bus. New schedules and new routes were quickly established to provide transportation for war workers from homes in defense housing projects to factory gates whenever the need arose.

The lack of sufficient new equipment with which to handle these varied assignments has caused the nation's bus operators to press into service hundreds of retired vehicles. Out-moded buses which in peacetime served only on weekends of heavy travel and were driven not more than 10,000 miles a year now are being operated 75,000 to 100,000 miles annually. By the close of 1944, approximately 4,000 intercity buses were reported to have seen over nine years of service, considerably more than the normal life expectancy of such vehicles.

To meet the urgent need for replacements, authorization has recently been given bus manufacturers to plan on the production of 3,500 intercity coaches during 1945. As part of this program, two automotive companies are cooperating to produce nine-ton, 37-passenger "parlor coaches." One, a peacetime builder of trucks and buses, makes the component parts. The other, a former passenger car manufacturer, assembles the big buses.

Huge Aluminum Stocks Used to Make Bombers

ENOUGH aluminum to supply every man, woman and child in the United States with at least two aluminum utensils has been consumed by an automotive company over a recently completed 32-month period. The aluminum was used in the production of heavy bombers for the Air Corps.

Of 133-million pounds of aluminum delivered to the plant in the period, 120-million pounds was in sheet form, for the fabrication of internal structures and outer surfaces, or "skins." Approximately six million pounds went into the manufacture of wire, rods, bars and rivets, of which there are 400,000 of the latter in each bomber. Tubing and extrusions accounted for the remaining seven million pounds.

More than 3,600 feet of tubes go into each heavy bomber, providing the vital arterial system for hydraulic fluids, gasoline, oxygen, vacuum and pressure pipes, speed indicators, engine oil, electrical conduits and ventilation.

Plants Help Workers Conserve Automobiles

Fully Equipped Garage Set-up by One Firm

TO HELP employes keep their automobiles in tip-top shape, automotive companies have developed many unique wartime services. The newest aid is a fully equipped garage where motor cars may be serviced or repaired while employe-owners work on their war production jobs.

In addition to encouraging swap-ride programs and share-the-ride pools, companies have assigned parking lot inspectors to repair flats, put air in tires, and leave notes on motor cars with worn-out tires recommending that owners make application with the company transportation department for re-capping or new tires. Another successful conservation program was the distribution of a 64-page booklet instructing employes on the best methods for keeping automobiles in good operating condition.

Staffed by trained mechanics, two of whom are returned war veterans and are utilizing skills developed during military service, the automotive company garage is prepared to handle major or minor repairs on all the makes of cars that daily bring 20,000 workers to their jobs. The garage functions on a 20-hour basis to accommodate workers on two shifts, and during its first two months of operation an average of 40 cars a day were serviced.

Most frequent service request is for motor tune-up, including checking of carburetor, distributor, spark plugs and fuel pump. Next is brake repair and adjustment, followed by alignment of front wheels to reduce excessive tire wear. Other services requested are complete motor overhaul, tire repair, lubrication and the sale of Grade one tires, anti-freeze, batteries and sundry items.

As part of its facilities, the garage has available a towing service which operates within a limited radius of the plant. In addition, transportation is provided from the garage to the job for workers who leave their automobiles for servicing or repairing.

PICTURE CREDITS: Page 3—Acme, top, and U. S. Navy, bottom; Page 5—Fifteenth Air Force; Page 7—Signal Corps.

Top left: **Forced landing results in smashed nose for a B-24.** *Top right:* **Second ship comes home with tail shot up.** *Bottom:* **The undamaged sections of the two wrecked ships are salvaged and joined, putting one serviceable bomber back into the fight.**

Interchangeable Parts Enable Army Mechanics to Construct Airworthy Plane from Two Wrecks

BECAUSE of the principle of interchangeable parts, even the old mathematical formula that two minus two equals zero is being discarded by GIs when servicing and repairing combat equipment in this war.

Basic to the American assembly-line method of manufacture used in the automotive industry, parts interchangeability has paid handsome dividends on battle fronts throughout the world.

Wherever replacement parts are difficult or impossible to obtain, vehicles, planes and weapons are "cannibalized," meaning that parts are salvaged from badly-damaged equipment for future servicing needs.

Through the ingenuity of GI mechanics, one complete bomber, which never should have existed, was recently recreated from two wrecked Liberators. When the first bomber crashed on its home airport in Italy, 15th Air Force mechanics, after examining the shattered forward section, decided to leave the remains untouched and wait. Almost a month later a second B-24 flew in with its tail damaged beyond repair.

Aided by automotive wreckers and mobile machine shops, a crew of Yankee mechanics moved the tail of one plane and the nose and wings of the other across the huge airfield. The halves fitted snugly and the jigsaw Liberator flew back into combat.

Anti-Mine Floor Developed for Army's Military Cars

NO LONGER will enemy land mines present as serious a threat of injury to crews of light armored military cars as they once did. For, working in cooperation with the United States Army Ordnance Department, automotive engineers have developed an anti-mine floor which affords protection to both driver and assistant.

The new floor consists of five sections of fully heat-treated armor plate and is shaped to fit over the front axle housing. Tested under simulated battle conditions recently at the Army's Aberdeen Proving Ground, the floor bulged but remained intact when German-type mines were exploded beneath a vehicle equipped with the device.

THE AUTOMOTIVE STATES — NO. 7 OF A SERIES

Motor Vehicle Production in Michigan Creates Jobs and Wealth in 43 States

WHATEVER its place or origin, the motor car you are driving represents the combined productive efforts of more than a million Americans.

Although Michigan played a major role in the mass-production drama which in peacetime made it possible for one American out of every five to own a motor vehicle, the supporting roles of 43 other states were of considerable importance.

As a famous automotive engineer once observed, "an automobile is nothing more than a crate of accumulated effort—the end product of many man-hours of work applied to it in the hundreds of communities through which it moved in its progress from mine and farm and forest to the end of some factory's assembly line and thence to the eventual user."

So, although most of the huge factories that have turned out 88,000,000 civilian motor vehicles since the turn of the century are concentrated in that small portion of Michigan which contains Detroit, Dearborn, Pontiac, Flint and Lansing, the lines of supply upon which these Michigan factories depend for raw materials, semi-finished and finished components reach into every corner of the continental United States and into many foreign countries. Similarly, when these Michigan factories gave the finishing touches to these "accumulations of effort" called motor vehicles and set them rolling toward their eventual owners the distribution was world-wide, and the sale and use of the product helped create more jobs to round out the production-consumption cycle.

Estimates have been made that half of every dollar spent for motor cars went into the far-flung supply-lines manned by miners, farmers, lumbermen, transportation and communication workers, factory and office employes in supporting manufacturing industries. The flow of accumulated man-hours in materials and parts to Michigan motor plants had no peacetime parallel anywhere, for the automotive industry of the United States was the world's largest purchaser of commodities produced by other industries.

From the ranchers in Texas came hides; miners in Minnesota's Mesabi range dug iron ore; cotton pickers on Mississippi's plantations and jute growers on Tennessee's small farms harvested the materials for fabrics.

In a typical production year the automotive industry was the largest consumer of at least a dozen important commodities, absorbing 80 per cent of all rubber goods, 73 per cent of the plate glass, 60 per cent of the alloy steel, 54 per cent of the malleable iron and 40 per cent of the mohair sold in the country.

Slightly over three years ago, Michigan's automobile plants turned out their last passenger cars for the duration, but the production pattern was enlarged and expanded to handle the great volume of war orders which flooded in on the state's motor plants. Since that date, the industry which turned out $3,700,000,000 worth of motor vehicles in its best pre-war year has devoted its resources exclusively to the production of tanks, shells, planes, military vehicles and over 300 other types of war equipment, valued at more than $9,300,000,000 in 1944.

By the close of last year Michigan's vast industrial facilities had delivered over $20,641,656,000 worth of military supplies to the armed forces.

Former automotive plants in Detroit are now manufacturing Navy anti-aircraft guns, tanks and parts, military vehicles, dive bomber wings, Liberator bombers, B-29 components, engines for all branches of the service, heavy calibre shells, rockets, buzz bombs, helmets and a host of other vital products.

In Iron Mountain, an automotive company produces gliders; Flint manufactures machine guns, aircraft engines, tanks and tank destroyers, automatic pilots and bombsights for aircraft; Lansing makes shells, guns and aircraft propellers; Saginaw supplies guns, ammunition and aircraft parts; Grand Rapids makes helicopter subassemblies; Kalamazoo turns out amphibious tanks; Pontiac builds guns and parts, 155 mm. shells, tanks and Ducks, and many other Michigan cities and towns are engaged in turning out parts and subassemblies for prime contractors throughout the state and the nation.

A recannaissance patral in Germany reports its findings by radio-telephone.

Peacetime Research on 2-Way Communications By Motor and Radio Experts Pays Off in War

TO THE list of gradually vanishing occupations, prepare to add that of the army dispatch runner—considered to be one of the most hazardous battlefield jobs a soldier can draw.

Thanks to wartime advancements in two-way communication, mobile radio-telephone units now transmit and receive the majority of vital front-line military messages. Embodying developments worked out jointly by communication experts and automotive engineers, two-way radio apparatus permits Jeeps, Weasels, command cars, tanks and reconnaissance cars, as well as air and ground units to be in constant touch with one another.

Automotive engineers entered the radio development field during the thirties, when American motorists began to demand efficient automobile receiving sets, and when police departments broadened the use of radio squad cars in crime control.

The elimination of "electrical garbage," interference caused by coils, spark plugs and motion-induced static, was the chief problem posed in those days. Tackling the job, automotive engineers and radio technicians developed filtering devices which eliminated the objectionable noises, and which in turn proved to be the answers to the prayers of military communication experts.

One of the earliest large-scale military radio-telephone applications, utilizing such filtering devices, was in the now famous Jeep. Then, although the original intent had been to fit the Jeep solely for reception of radio messages, the automotive engineers carried the idea an important step beyond the military demand.

Built was a powerful light-weight generator, capable of being quantity-produced on the production and assembly lines used to manufacture automotive starters and ignitions. The new product, enabling the Army and Navy to equip internal combustion engines with high output generators, made it possible to carry on two-way radio communication over greater distances and for longer periods of time.

Subsequent military applications of this development in World War II has helped to cut down the frequency with which the time-honored dispatch runner is called upon to get messages from one front line fighting unit to another.

With its value to modern mechanized armies firmly established, two-way radio communication has also begun to perform an important civilian role. For example, a former automobile body factory now making aircraft parts has installed radio-telephones as an adjunct to its materials handling operations.

From a central panel in the huge plant, a woman dispatcher directs the operations of eight overhead cranes, eliminating the old system of hand signals, flasher lights and warning horns.

In transportation fields, several railroads have installed equipment which makes possible conversation between dispatch station and moving train, as well as from train to train.

Looking toward the postwar years, truck and bus operators are planning networks in which low-frequency radio-telephone units will keep drivers and dispatchers in constant communication within a 100-mile radius.

Motor Firms Cooperate In Brake Safety Drive

TO REDUCE accidents and help conserve the nation's dwindling stock of passenger cars, automotive companies and their dealer organizations have completed plans to cooperate in a nation-wide brake safety campaign sponsored by law enforcement agencies.

A recent survey shows that automobile registrations have dropped to 25-million from a peacetime mark of 29½-million, and passenger vehicles are currently leaving the road at an estimated rate of 2,500 daily.

Nearly twice as old, on an average, as they were in pre-war days, passenger cars continue to transport the bulk of workers to busy armament plants. Approximately 70 per cent of the employes of 191 typical war plants depend on private automobiles to reach their work, the survey reveals.

Running for six weeks beginning April 15, the national program calls for a brake check of passenger cars involved in accidents and traffic violations, as well as those operated in such a manner as to indicate equipment in poor repair.

As their part in the program, automobile dealers will accord brake servicing top priority during the period, outranked only by repair work which must be done on commercial vehicles needed in the war effort.

A brake check requiring one minute has been developed by automotive engineers as part of the drive. To make the check, a one-inch block of wood is placed under the brake pedal. If, when depressed, the pedal touches the block, equipment is probably defective.

Planning and Operation of Line Production Is Similar to the Workings of a Cafeteria

THE COMMONPLACE cafeteria provides an example of the operation of line production, the method used by the automotive industry to make motor cars or military supplies in volume. At the cafeteria the tray moves from assembly station to assembly station, gathering food, so that when it reaches the end of the line it carries a complete meal.

Preparations for line production, as for getting food on the cafeteria table, are largely a matter of timing. Before the cafeteria can function, farmers must plant and harvest in proper season. Foods must be transported from farms to markets to outlets, and all components must be processed, prepared in the kitchen and finally brought to the various assembly stations.

In a like manner, demand must be calculated in advance before parts for automobiles can be produced by the line method. Manufacturing machines must be installed in proper sequence in the factory, raw materials and subassemblies must be ordered and must arrive in the plant at various precise moments, and workers must be on hand in sufficient numbers to man the production lines.

The terms mass and line production are frequently used as synonyms, but there is a distinct difference. Although both are high volume manufacturing methods, mass production may be obtained from one machine while line production is characterized by progressive layout of work. Examples of mass production are safety matches, produced at the rate of millions hourly; cigarettes, made at the rate of millions daily; tin cans, of which millions are made monthly; and motor vehicles, built in peacetime at the rate of millions annually. However, on this list, only automobiles exemplify both the mass and line production methods.

War Production News-Briefs

More than 30,500 engines for Liberator bombers and military cargo planes were turned out by a former motor car company last year.

Production of about 18,000,000 bearings monthly is needed to meet military and essential civilian requirements.

Approximately 2,000,000 American-made military vehicles are in use throughout the world, the War Production Board recently announced.

DID YOU KNOW?

Since 1940, one automotive firm has delivered more than 143,580,000 units of firepower to the armed forces. These include 140,000,000 shells and casings; 180,000 cannon; 1,000,000 machine guns, and 2,400,000 carbines.

* * *

To reveal porosity, slag and other hidden flaws in the armor plate, castings and weldments of tank and tank destroyers, an automotive company recently installed a 1,000,000 volt X-ray machine in its factory.

* * *

Eliminating hours of tedious hand riveting, a 500-ton fast traverse press is now being used by an automotive company to rivet fin bulkhead spars for heavy bombers. Handling two spars at once, the press requires 10 minutes to place, rivet and tack 270 rivets. By the old method, 50 minutes were needed.

* * *

More than 5,000 engine nacelles for Superfortresses have been delivered to the Army Air Forces by an automotive company since the beginning of the B-29 production program. Composed of over 3,000 parts, each nacelle weighs approximately one ton, is nearly 12 feet long and seven feet high. The company estimates that more man-hours of work are required to build one set of B-29 nacelles than to complete the ordinary fighter plane.

* * *

Designed to aid in the development of ship instruments and controls, a 60-foot ocean-going marine laboratory with a 1600-mile cruising range has been built for an automotive company. In addition to laboratory facilities, the ship houses a complete machine shop, enabling the company's engineers to re-design or re-build any device under test without returning it to the factory.

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Automotive Plants Meet Demand for More Planes

More thon 8,000 Liberotor bombers have gone from the ossembly lines of one outomotive plont to world bottlefronts.

Improved Tooling Steps Up Operating Efficiency And Helps Industry to Reduce Manpower Needs

MORE air-power in the skies over enemy territory . . . less man-power in the factories! More bombers, more fighters, more engines to propel them . . . yet the demand upon America's manpower resources to produce this year a total of 78,227 planes is far short of the 1940 labor estimates when the cry first went out for "50,000 planes a year."

Better utilization of the working force, more experience with the product, attainment of volume production have all contributed to this record.

And there are other reasons behind the record, too—important ones; better tooling, improved methods, production shortcuts. Above all, there is mastery of that uniquely American art, the production of the largest possible total of needed things in the shortest possible time, with the least possible expenditure of time and effort, and with every possible improvement of the quality of the output. Briefly, mass production.

The automotive industry, which in peacetime became a world-recognized symbol of this American art, last year delivered $4,193,000,000 worth of aircraft products to the Army and Navy, nearly 19 times as much as was turned out during the first year that motor plants took on such contracts.

(Continued on Page 5)

Robot bomb is looded on toke-off romp in Florido for test flight.

Army Air Forces Turn to Automotive Industry For Development and Production of Buzz Bombs

THE sky over England last summer spewed death. A *put-put-put,* like the sound of a giant out-board motor, followed by a *sw-o-o-s-h* as the engine cut out and the "thing" plunged earthward, was the only harbinger.

This was the dreaded robot bomb or V-1, Nazi Germany's desperate attempt to fashion a weapon which would hold back the engulfing forces of the Allied armies.

From the twisted junk of one of these "buzz bombs" which failed to explode when it struck the English countryside at more than 400 miles an hour, American automotive engineers in cooperation with the Army Air Forces have designed and placed in production a vastly improved version of the original "pilotless airplane."

To fill requirements for the new weapon, the Air Forces turned to two automotive companies, both of whom had been producing aircraft and components since the start of the war program.

One company, a supplier of turbo-superchargers, engines and other precision equipment, was assigned the job of designing and constructing a workable jet impulse unit to power the American robot bomb. The other firm, a producer of aircraft subassemblies, was asked to build the wings, the fuselage which contains 2,250 pounds of high explosives, and to assemble the entire unit for delivery to the Air Forces.

When the request was received the engine-producing company rushed three engineers to Wright Field at Dayton, Ohio, to study the only available information on the German V-1, a sketchy Allied Command report describing the apparent construction details of the unexploded propulsion unit, and the badly mutilated parts of the shattered Nazi aerial bomb.

Drawings were made on the spot and along with smaller parts were rushed to the automotive company's factory, where metals, which had to withstand a sustained operating temperature of 3,000 degrees, were analyzed. Strictest secrecy was observed. Automatic welding machines as well as special fixtures to hold component parts were designed and built by the company's engineers. Trusted production men worked day and night in widely scattered sections of the plant to complete the hundreds of precision parts needed for the propulsion unit.

Within 21 days, eleven of which were consumed in study and drafting, the first automotive-built robot bomb propulsion engine, 12 feet long and one foot in diameter, was mounted on a test block before an especially-designed wind tunnel, thundering a 600-horsepower song of defiance at the Axis.

During the same period, the automotive company charged with producing the bomb's wings, body and war head which holds the explosive mixture was following a similar procedure.

While the company was preparing its facilities for the new job, blue prints, painstakingly recreated from the broken and bent fuselage of the German V-1, were being completed by aircraft experts at Wright Field. At the plant, automotive engineers studied the job's requirements as fast as the drawings were speeded in, and from their findings production and tooling men set up the necessary mass output facilities.

Within 60 days of the time an Air Forces' contract was placed, aerial bomb fuselages were coming off the company's assembly lines.

Welded from five sections of formed steel and weighing 2,500 pounds without its explosive charge, the fuselage is 27 feet long and 33 inches in diameter at its greatest girth. The magnetic compass, gyro equipment and a timing device, which throws the robot into a spin when the target is reached, are housed in the ship's fore section.

Salvage Systems Save Materials and Labor

AN automatic salvage system, which collects, prepares and loads four tons of steel turnings into railroad freight cars every hour has been designed and installed by an automotive company in its shell plant. A producer of 155 mm. projectiles, the company developed the idea in an effort to cut down manpower waste and to obtain needed extra shipping space.

Here is how the unique system works. Between the rows of cutting machines which transform rough steel forgings into finished shells, a trough several feet below floor level has been installed. Turnings drop into the trough and are washed to one end of the plant by waste cooling fluids from the same shell producing machines.

Picked up by a conveyor at this point, the turnings are brought to a chopping machine which converts them into small chips. A second conveyor then carries the chips by means of a vertical belt to the top of a loader, which drops them into freight cars.

American-built trucks speed flow of supplies for Russian Army.

Military Vehicles Made by Automotive Industry Spearhead Russian Drive on Eastern Battlefront

DAY and night, American-made combat vehicles roll out of a steaming Persian Gulf port and head north across the Iranian Desert under a blazing sun. Their destination is Russia, 800 miles away.

At Murmansk, Archangel and other Russian seaports, great ships drop anchor and disgorge similar cargoes from well-filled holds.

Since March 11, 1941, when the Lend-Lease Act took effect, these scenes have been repeated countless times as 362,000 vehicles, including 46,000 Jeeps, were rushed from a dozen American automotive companies to the Russian Army.

Last year alone American plants shipped 144,000 vehicles to the Eastern Front. Among these were 6,000 tanks, 1,800 self-propelled guns, 1,200 half-tracks, 3,300 armored scout cars and 1;700 ordnance service vehicles.

On some sections of the Russian Front, according to a United States Government official, American trucks carry more than one-half of all the supplies needed by the Red troops. These vehicles consist of standard cargo carriers, Jeeps, weapon carriers, amphibians, tractors and special service equipment; the major portion being made up of 1½-, 2½-, and ¾-ton weapon carriers.

The Lend-Lease allocation of motor vehicles to Russia, as to all Allied nations, is determined by the over-all supply needs of respective military forces. To help meet the Soviet requirements in the past three years, three automotive companies have supplied 137,859 two and one-half ton trucks; two other companies have built 134,229 one and a half ton trucks; a sixth company has delivered 21,570 three-quarter ton trucks.

In addition, eleven motor plants have sent approximately 9,020 special purpose vehicles, such as truck-tractors, flat-bed trailers, dump trucks, "Ducks," ten and twenty-ton cargo trucks and heavy-duty wreckers, and track-laying tractors to haul artillery and supplies.

One of the most unusual vehicles sent to Russia was a six-wheeled, 73,000-pound Diesel truck. Designed and built by an automotive company from Russian specifications, the vehicle mounts a complete oil well drilling outfit, including the derrick.

Trucks Rush Supplies On New ABC Highway

THE veteran Red Ball Express drivers have scored again.

Their ten-ton cargo and gasoline trucks, 1,200 strong, no longer bear the insignia of the famous *Red Ball,* but, at this writing, their roaring engines were making another motor convoy route—the American-British-Canadian Highway—as popular to frontline combat units as the Red Ball Express was to the GIs who pushed the Nazis out of France a few months ago. According to recent reports, their turning wheels bore much of the weight of heavy equipment, including huge naval craft, which broke across the Rhine barrier to start the Western Front thrust into the heart of Germany.

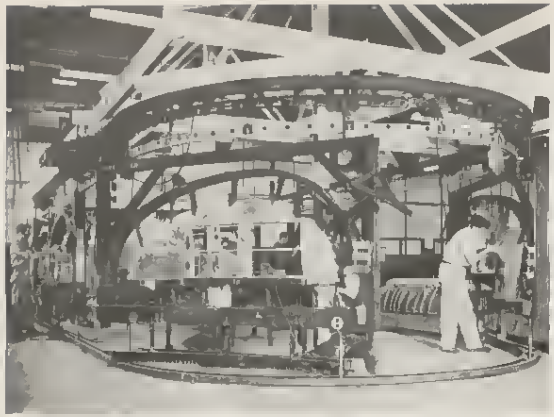
After the Channel ports fell to the Allies, the Army Transportation Corps was able to utilize European railroad facilities and discontinue its Red Ball Highway, over which more than 500,000 tons of supplies had been carried.

Addition of the Belgian port of Antwerp to the Allied supply chain gave birth to the new route, which stretched across ancient cobblestone streets, dirt lanes and modern concrete highways from the seacoast to Louvain, Liege and other advance depots.

The magnitude of the ABC motor convoy operation can best be appreciated from the fact that 20 motor truck companies are needed within the port of Antwerp itself for transportation of cargo from dockside warehouses to a "surge pool," or assembly point. It is here that the 10-ton trucks, in units of 13, pick up their loads and roar towards the front lines.

Motor convoy is formed in Belgium.

Management In Action



B-29 wing tips are framed and skins attached on special merry-go-round conveyers.

Here Is What It Takes to Set-Up a New Factory In Response to Army Needs for B-29 Assemblies

IMAGINE yourself an automotive executive who has been requested to build a brand new war product, in a plant to be erected 514 miles from your home office, manned by workers not yet hired and having no previous factory experience How would you go about it?

Automotive officials have met and conquered many such problems time and again in producing 24 billion dollars worth of war materials to date. How one company solved those difficulties and produced within a relatively short space of time outer wing panels for B-29 Superfortresses is generally typical of the industry's far flung wartime expension

When the B-29 program was being developed by Army and aircraft officials, an automotive company, formerly a builder of passenger car bodies and then producing wings and engine nacelles for Flying Fortresses, was asked to make the larger wing unit. Thirty feet long, comprising 55,970 parts, not including 25,000 rivets, it is one of the major B-29 airframe components

To make detailed studies of the parts to be manufactured, engineers from the company visited the prime contractor on the West Coast, Shortly after, on January 6 1943 the president of the motor firm received 100 pounds of blue prints, which were turned over to production experts for study, analysis and comparison with the Flying Fortress wing, a job currently in production.

However, the company could not make these wings in its existing plant because facilities were already operating at capacity, and the community had been proclaimed a No 1 manpower shortage area

At this stage, management "know-how" was dramatically exercised Without knowing where to locate a new plant, but acquainted with what was to be made, and how many in a given time, and based on experience gained building B-17 wings, the company produced detailed blueprints for a new structure

On them, the plant layout chief located each machine and conveyor line The process department ordered the required jigs and fixtures and compiled a volume of production route sheets nearly a foot thick which showed each consecutive process and assembly operation of the new product The time standards department estimated the time required for each step Plant engineers placed orders carrying triple-"A' priority for necessary machine tools The supervisor of small tools ordered the right number of hand tools, such as machinist s hammers, screw drivers, and the like The personnel director determined the number of workers required for each operation and for maintenance

At last manpower was found to be available in a small Eastern city, and the first shovel of dirt was turned Juoe 15 1943 Floodlighted at night, construction proceeded on a wartime around-the-clock basis

In temporary offices, the compeny received job applications resulting from full-page advertisements. Those selected left surface jobs at nearby coal mines, came from the nearly dormant building trades, and other fields All were placed in a newly organized company school to learn riveting, welding, drilling or assembling

Those possessing supervisory qualifications were given condensed courses in production work, and additional intensive instruction in the fundamentals of leadership, so as to quickly augment the management staff

While the plant was going up 32-foot jigs and fixtures to hold the huge wing panels were built and subjected to rigorous testing to assure holding their shape under stress As a final gauge of accuracy, 10 actual wings were built on these, and found perfect To double-check productive equipment, the jigs and fixtures were shipped to the aircraft company where they were inspected, okayed, returned to the automotive company and then reshipped to the new plant

Wing sections receive final inspection.

Only two walls of the new building were built when first manufacturing operations, comprising subassembly work, began October 15, 1943 The workers were shielded from the chill Fall winds by tarpaulins, and in the absence of heating boilers, two locomotives were parked on a nearby siding to provide steam heat The "iron horses" served the plant throughout that winter

Machines, conveyor lines and other items of equipment were rapidly installed and production went into high gear as the last brick was laid on November 19, 1943

On January 27, 1944, the plant resounded with the cheers of workers as the first pair of wings rolled off the final assembly line, nearly six months ahead of schedule.

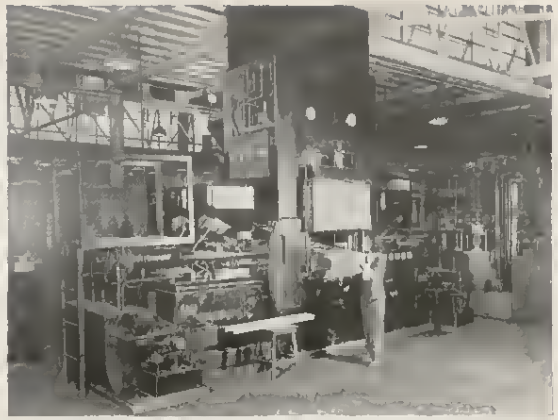
Weapons Are Improved By Plant Cooperation

EVEN with three and one-half years of war production experience, the automotive industry continues to pool technical and productive knowledge

Not only are the latest solutions to such common problems as manpower, materials, tooling, design changes and new techniques freely exchanged, but even plant facilities are made available whenever the need arises

For example, one automotive company which builds bombers, aircraft engines and combat vehicles has made its extensive testing facilities available since Pearl Harbor to a host of manufacturers who turn out components for such military supplies

Among the war products tested in this company's laboratories heve been propellers, ignition systems, generators, spark plugs, starters and a self-locking device for tank-hatch covers To date, the company has contributed an estimated 8,500 hours of "official" test time to various accessory builders



New 500-ton press drives 270 rivets in single operation. Time saved: 20 minutes.

Improved Tooling Helps Automotive Industry Meet Increased Military Demand for Aircraft

(Continued from Page 1)

Currently, the production of bombers, fighters, gliders, helicopters and subassemblies like wings, fuselages and engines comprises 45 8 per cent of the industry's war work.

Here are just a few of the industry's production accomplishments in its drive to meet the nation s military air needs.

More than 9,000 completed planes for the Navy have come from one company, over 8,000 Liberator bombers heve been produced by another firm, one plant has turned out more than 34,000,000,000 spare parts for B-29 engines, production of all types of aircraft engines by the entire industry now exceeds the 345,000 mark.

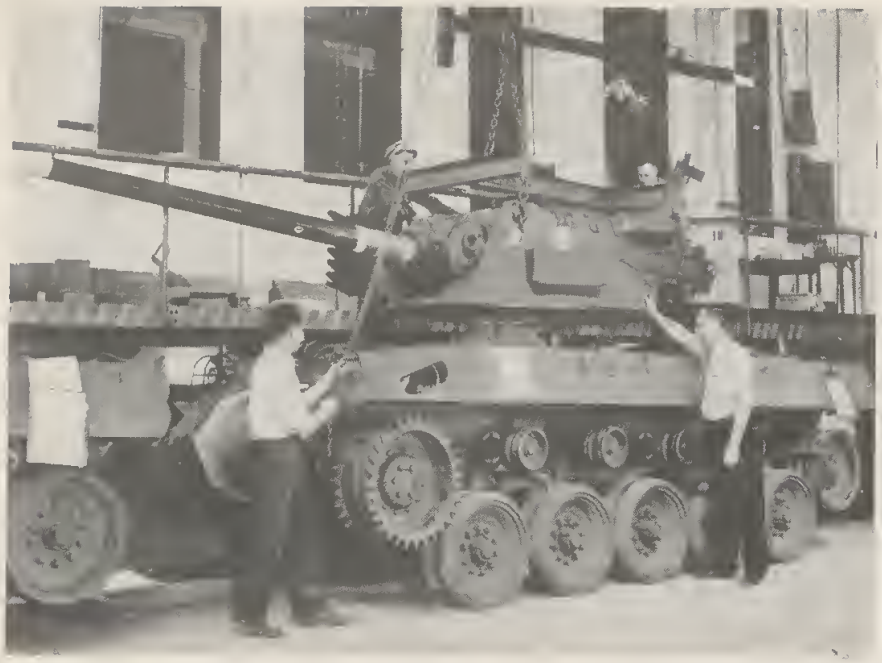
Instances abound in the automotive industry where development of more efficient productive equipment and methods have helped plants to meet these difficult aircraft schedules and release sorely needed manpower for other urgent war work The following examples typify the long-standing practice of finding new ways to increase output and improve product quality

In the finishing of aircraft connecting rods, special automatic machines were designed to grind contours, resulting in a saving of 11 4 hours on the grinding of the rods for each 12 cylinder engine These parts are then shot-blasted to give the desired finish, with a saving of more than 14 hours per engine as compared with polishing by hend The latter operation released 400 men for other war work.

The technique of tumbling, in which parts are placed in revolving barrels and emerge with a prescribed polish, has been applied to aircraft camshafts. Result a saving equivalent to 200 man-hours per day

A process machine, which performs a complete series of machining operations as contrasted with a machine that performs only a single operation, has been developed to help increase output of aircraft engine cylinder heads The machine, a 16-station piece of equipment, performs 25 different operations on the front cylinder head, using 67 separate tools, and 20 operations on the rear cylinder head, using 47 tools.

In use, the machine produces one completed cylinder head every 45 seconds and requires 24 men to operate it. To obtain an equivaleot production with methods employed before the war would have involved procurement of 60 individual machine tools and the hiring of 162 men to operate them



M-18 Hellcats have replaced passenger cars on plant's assembly line.

Design Improvements by Automotive Engineers Increase Mobility of Track-Laying Vehicles

THIS is the story of an engineering accomplishment which is helping to revolutionize American tank design.

It grew out of a demand by the armed forces for a swift, sturdy tank destroyer, capable of darting up to an enemy armored formation, firing a high-velocity shell and slipping away before defensive fire could be brought to bear. The vehicle's function was to be similar to that of the Navy's famed PT boat—strictly a raider.

The job was brought to an automotive company and from the engineers' drawing boards came the potent M-18 tank destroyer, nicknamed "the Hellcat." Weighing 19 tons, with a welded armor plate hull and a 360 degree revolving turret mounting a 76 mm. cannon, the track-laying vehicle attains a speed of 55 miles an hour. According to Army Ordnance engineers, the weapon's ability to negotiate barriers, trenches, deep water, mud, and mountainous, heavily-wooded terrain exceeds that of any motorized artillery developed to date.

Secret of the M-18's mechanical agility, which gives it maneuverability comparable to a modern passenger car, lies in a unique application of individual wheel suspension incorporating the use of torsion bar springs and double-acting automotive type shock absorbers.

The principle of torsion bar springing is not a new one, but its successful application to heavy combat vehicles ranks as an outstanding engineering achievement.

Two motives prompted the automotive engineers' decision to design a vehicle incorporating the torsion bar. First, the conventional type spring, fitted on the outside of a vehicle, had proved vulnerable to enemy gunfire, whereas torsion bars are encased within the vehicle's hull, affording the vital component the protection of steel armor plate. Second, engineering data proved torsion bars to be the most efficient use of spring material.

Torsion bars, of which there are 10 to a vehicle, are just over six-foot-long solid shafts of high carbon alloy steel, notched like a saw at each end. One end of the bar engages in an internally notched axle shaft which is integral with a support arm. The other end is anchored in an axle shaft housing on the opposite side of the tank destroyer hull.

As the vehicle's track wheel moves upward, when passing over an obstruction, the support arm pivots as much as 50 degrees in the axle shaft, in turn imparting a twist to the torsion bar. The bar resists this twisting action and therefore functions as a spring. In production, each torsion bar is given a definite twist, or "set," in the direction the bar will twist in supporting the vehicle.

To manufacture the torsion bars, the company set up 28 operations. With the exception of two of the processes, the one in which the bars are "set" and a shot-peening operation, company engineers were able to utilize production equipment which once had helped to turn out peacetime passenger cars.

To date, the company has built more than 35,000 torsion bars, and service reports show that only one of these has failed. At the start of the M-18 production program, Army schedules called for an output which included 16 per cent for spare parts purposes. Currently, production of spares has dropped to two per cent and these are for the sole purpose of servicing vehicles damaged by enemy action.

So successful has the torsion bar spring proved that the company has been asked to build this component for all the tanks manufactured by three other concerns; while the Army Ordnance has specified that all combat track-laying vehicles produced in this country be equipped with torsion bar spring systems.

Idea Cuts 100 Pounds From Weight of B'29s

TO the continuous attention which Americans on the production front give to the "tremendous trifles" of their work, Americans on the fighting front owe much of the superiority of their weapons and combat gear.

One such "trifle," currently paying dividends to the crews of B-29 Superfortresses, came about through the redesigning of an air duct, part of the huge cowling unit which goes around each of the big bomber's four engines. Composed of die-formed aluminum and stainless steel sheet stock, rivets, machine screws and castings, the air ducts are assembled by an automotive company from components fabricated by a large number of suppliers.

As worked into the assembly process by the motor company's engineers, the design changes resulted in a weight saving of about 25 pounds for each engine installation, or about 100 pounds a plane. In addition, the time required to make the part was reduced approximately 35 per cent.

First Yellow Cab Result Of Woman's Whim

Vehicle Appeared On Street in 1908

LATE in the year 1888, two New Yorkers, Albert and Edward Rockwell, started a small manufacturing business in an abandoned room of an old clock shop in Connecticut.

The brothers had been in Florida but had left hastily when a yellow fever epidemic had broken out. While heading north, they had figured out a scheme for making doorbells operate on a clockwork mechanism instead of the messy wet-cell batteries which were then the customary power source.

From a beginning with doorbells, the Bristol company expanded into fire, tea, cable-car, office, rotary call, automobile, bicycle and alarm bells. The following year, the cycling craze helped to expand the company into still other fields such as oil lamps, trouser guards, coaster brakes, ball bearings and lubricants for bicycles; and as bicycles introduced motor cars, the Rockwells decided to get into the "auto game."

In 1904 they made a small automobile with a 15-horsepower engine, and in 1908 they ventured further into the automotive whirl with their Rockwell Public Service Cab, a four-cylinder taxicab with a fancy "R" emblazoned on the rear door.

Originally the vehicle was painted black. To make it more distinctive, the Rockwells pondered a color change, but could not make a choice. Mrs. A. R. Rockwell was asked to decide, and she immediately responded, "Yellow."

This was the first yellow cab in the world. Soon afterward, fleets of the bright colored vehicles were a common sight in most American cities.

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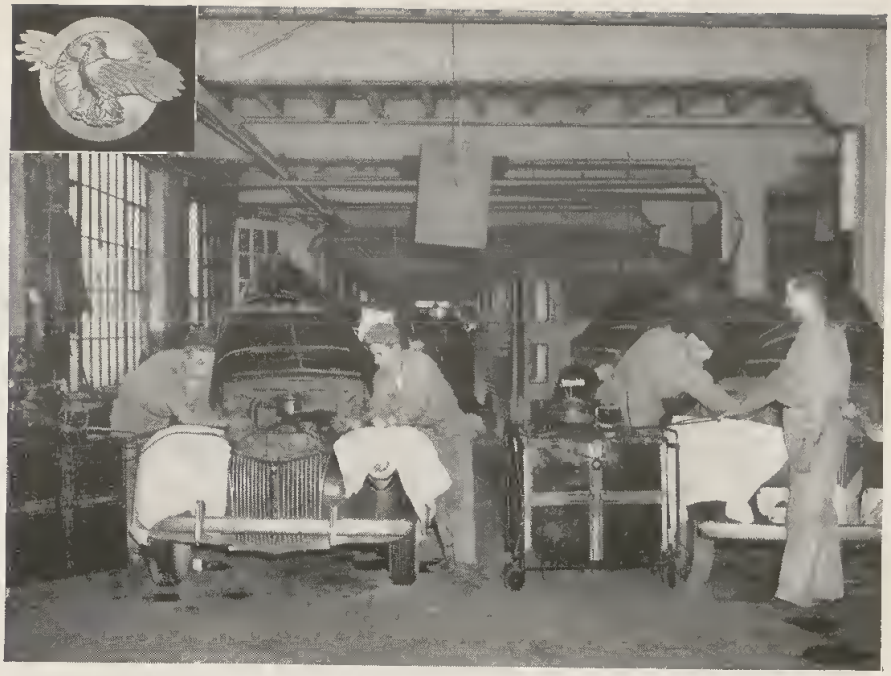


World War II veterans learn fine points of servicing civilian motor vehicles.

Veterans Learn Automotive Sales and Servicing Under Training Programs Sponsored by Plants

To encourage World War II veterans to work toward ownership of their own businesses, several automotive companies have inaugurated "earn-while-you-learn, full-paying" apprenticeship plans whereby returned soldiers may be trained in the fundamentals of automobile sales and servicing.

One of the most lucrative employment fields connected with the industry, it engaged in sales and service of motor vehicles in pre-war years a total of 1,300,000 persons. This total (equal to the population of Nebraska) was approximately twice as many persons as were then employed in manufacturing operations in the motor industry.

Under the plan sponsored by one company, an accepted applicant is taken in as a member of a dealer's organization and trained in all phases of the business, with the opportunity to concentrate training in the department of his choice.

Upon completion of the educational phase, and if the apprentice has made good progress and is qualified, the dealer may allow him to assume the responsibility of sharing in direction and management of the business.

Finally, when a background of experience has been built up in the several departments of an established organization, the veteran will be in a position, according to company officials, to fill regular dealership vacancies along with key men now employed in the firm's distributing organization.

To date, more than 2,300 veterans of World War II have enrolled in this company's apprenticeship program.

A second company, concentrating on the service end of automobile distribution, has already begun a nation-wide program to fill a minimum of 6,000 jobs in its dealer organizations with veterans who possess mechanical training or "merely have the desire to be a mechanic."

The company is conducting schools in each of its distributing zones, and dealers are working closely with veteran's groups in filling the jobs. To aid the recruitment of veterans, daily newspapers and military publications will carry detailed announcements of the program, the company reports.

PICTURE CREDITS: Page 1—15th Air Force; Page 2—Air Technical Service Command; Page 3—Sovfoto, top, Signal Corps, bottom; Page 7—insert, Signal Corps.

Small Manufacturing Concerns Have Major Role In Output of Components for Motor Industry

LAST year there were slightly more than 3,000,000 individual business establishments in the United States engaged in manufacturing operations, the distribution of goods and the service industries.

Of these, 1,000,000 were one-man affairs, 2,000,000 employed less than 100 persons, 35,000 had between 100 and 1,000 workers and only 3,300 reported more than 1,000 employes.

In the field of manufacture, approximately 91.6 per cent of the nation's 184,230 establishments employed less than 100 persons. Thirty per cent of all workers held jobs in these plants. They turned out 30 per cent of all goods produced. Among manufacturers, there were 8,300 one-man companies, nearly 76,000 plants employing less than five workers, 49,000 firms which had from six to 20 workers and only 176 producers employing more than 2,500 people.

This survey, conducted by the Committee for Economic Development, means that for every 44 people in the United States, there was one business concern.

However vast the field of its operations and however centralized its managerial controls, no automotive manufacturing company, for instance, could possibly make all the parts that combine into the final product without the aid of hundreds of these small independent enterprises, whether that final product be guns or motor cars, ball bearings or bombing planes. Rather, they rely, in wartime as in peacetime, on thousands of "subcontractors" of varying size, located in nearly every state in the Union, and each specializing in production of one or more component of the eventual whole.

One automotive company, for example, shares its war work with 18,375 concerns, most of them plants which in peacetime supplied motor vehicle components. Of these, 74 per cent employ less than 500 persons each and 58 per cent have less than 100 employees.

Another former motor car company depends on 8,079 individual subcontractors, located in 856 cities in 39 states, for 60 per cent of the parts going into its 21 major war products. Of these outside firms, 59 per cent are classified as small, 19 per cent as medium and 22 per cent as large.

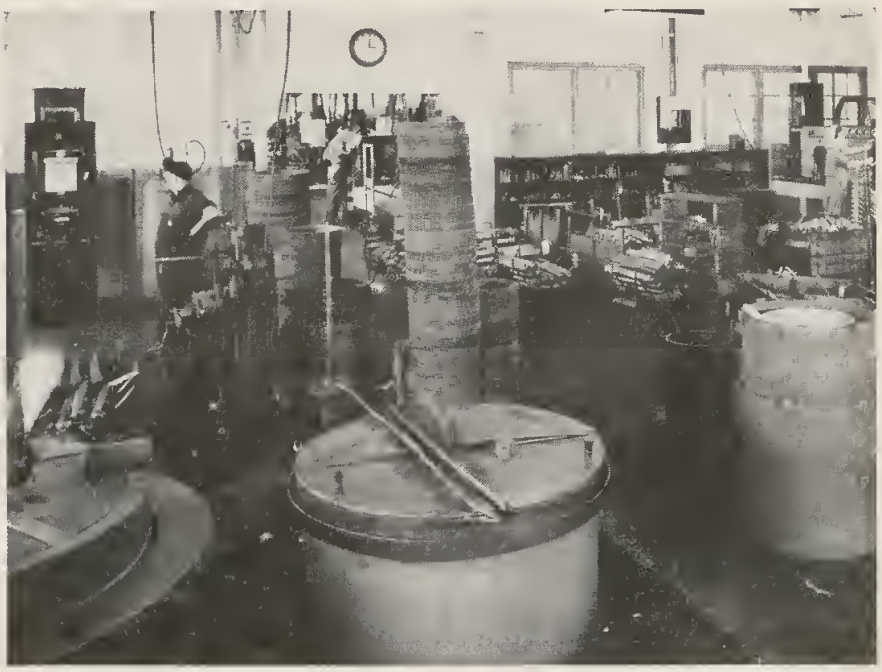
How does a small manufacturer, one to which many automotive plants look for vital component parts, come into being, grow and prosper? Take the case of a plant which supplies gears.

Founded in 1917 to make automotive replacement parts, the company is located in a small community in eastern Indiana.

As the business of manufacturing became more specialized the firm began to concentrate on the making of precision gears on a mass production basis. Before World War II stopped peacetime operations in the motor car industry, the company was supplying 15 automobile companies with four types of bevel gears, two types of spur gears, a flywheel starter gear, and other special types.

Begun with three people, the company has enlarged until today it employs 300 people, with annual sales to the automotive industry alone in the seven-figure bracket.

Precisian gears are heat-treated before shipment to automotive assembly plants.



AUTOMOTIVE

WAR PRODUCTION

Vol. IV No. 4

May, 1945

HONOR ROLL

374,000

SETTING aside the familiar tools of production and picking up the strange weapons of warfare, automotive workers have left lathes, drill presses, tool rooms, assembly lines, clerical tasks, engineering and executive offices and gone forth to the world's battlefronts in a force sufficient to man just under 25 modern infantry divisions, a recent survey shows.

The 374,000 stars on the industry's service flag, representing the men and women who have entered the Armed Forces since Pearl Harbor, cover the 550 member companies of the Automotive Council for War Production.

Nearly every automotive war worker—from the desks of management to the shop benches—has a close relative under arms. At one plant, for instance, three employes—a tool maker, an assembler of aircraft engines and a parts distribution supervisor—each report five boys in uniform. In another company, a drill press operator has four boys and a girl in service. A foreman in a third plant, which makes B-29 components, has seen five sons and a son-in-law leave for military duty. With five sons overseas, the president of still another company is constantly reminded of his wartime obligation.

AUTOMOTIVE INDUSTRY REAFFIRMS PRODUCTION PLEDGE TO HELP SPEED VICTORY OVER JAPAN

THIS is a time for re-dedication, rather than celebration.

In full recognition of the meaning of the moment, the Automotive Council for War Production reiterates the pledge with which we of the automotive industry dedicated *all* our facilities to production for the nation's defense in the dark hours of December, 1941.

On this occasion, we feel that the highest tribute we can pay to the people who made V-E Day possible is to continue our work in such manner as to assure them of our sincerity of purpose in rededicating ourselves to that pledge.

Production of war equipment to bring about complete victory over *all* of the nation's enemies at the earliest possible moment and at the least sacrifice to the people of our armed forces will continue to be the first order of business for this industry until the last shot is fired.

However, the ending of the war in Europe does bring to the forefront many vitally important problems for government, industry and workers.

From now on, the automotive and other industries face a dual task involving the maintenance of high production under continuing war contracts and simultaneously resuming civilian activities as speedily as possible at such levels as will not interfere with their primary work on war materiel. Only by so doing can unemployment for an indefinite period be minimized.

Management and workers of this industry are most acutely aware of the huge size and complexity of the problems involved in rearranging and rebuilding our manufacturing facilities for automotive production. The task is made particularly difficult by the sweeping manner in which automotive plants were torn up and reorganized in the early months of the war to enable this industry to handle the enormous war production load it has carried.

In preparation for partial resumption of automotive production at the earliest possible moment, various government agencies recently authorized the industry to take some preliminary steps such as placing orders for machine tools and proceeding with plant reconstruction. Industry executives, too, are working vigorously to remove remaining obstacles which might cause avoidable unemployment during the transition period.

ALVAN MACAULEY, **President**
Automotive Council for War Production

May 8, 1945

Management Know-how Enables Five Motor Plants to Function as Largest Navy Plane Builder

LATE in January, 1942, just a few weeks after the Pearl Harbor disaster, an automotive executive left the Navy Department in Washington for his home office. Under his hat he had a request to produce two types of aircraft he had never seen; in his mind he mulled over the fact that he possessed no manufacturing set-up with which to build them.

Within a few days, however, the management of his company, which operated five special purpose automotive assembly plants along the Eastern Seaboard from Tarrytown, New York, to Baltimore, Maryland, had taken the first steps toward combining these units into a single operation.

In August, only seven months later, a complete new manufacturing organization was in operation. This infant company subsequently became the Navy's largest supplier of Avenger torpedo bombers and Wildcat fighter planes, building in 32 months a total of over 9,000 aircraft.

At the time of the consolidation one of the plants housed an operation which in the five previous years had assembled 343,000 passenger cars.

Forty-two miles away was the second unit, a factory which made automobile hardware at a peak rate of 750,000 items daily. The other units were two automobile body assembly plants and a large battery plant, all located in different communities.

On March 23, 1942, the Navy contract for bombers arrived and two days later the fighter plane contract came in. But beginning on February 21, 1942, in anticipation of these events and continuing through to the end of July, 1942, the new company's management initiated, supervised and tirelessly pushed the dismantling of the five plants, proceeding on a 24-hour basis. Speed was imperative, for the contracts stipulated that the first fighter plane was to be off the line by October, 1942, and the first bomber by November, 1942.

From one factory alone, technicians of the Plant Engineer's office directed the rooting up and removal of 1,400 square feet of boiler plate, tanks, ovens, welding jigs and other peacetime equipment. As part of the alterations the roof was raised 26 feet.

Nearby, at one of the other plants, bulldozers levelled earth and plowed out an airport, complete with hangars and runways. More than 120,000 manhours were expended here in stripping the plant and removing equipment to storage. Of 1,104 peacetime machines, the Master Mechanic's Office converted 243 to war work, stored 617, sold 36, sent 106 to other plants, and returned 41 to original lessors.

At a third plant more than 1,000,000 pounds of equipment was ripped out and carted away.

During this period, automotive production engineers, in conference with aircraft men, decided how to break down the aircraft for mass production, and which parts of the two planes each of the five plants would produce.

While the plants were being converted, the Personnel Director and his assistants came to grips with the staggering problem of hiring and training an estimated 43,200 workers. Major training feature was to select a supervisory group to act as an advance guard in acquiring knowledge. These in turn taught all the others.

By March, 1942, Production Engineers had ordered a total of 2,240 machine tools, and installation of the new equipment was in full swing.

Complicating the tooling situation, however, were numerous design and engineering changes which flowed back from all fighting fronts and affected both the fighter plane and the bomber. For example, when, after combat experience in the Pacific, the Navy decided to increase the number of guns installed in the fighter plane, this one design improvement involved changes in 4,000 engineering orders.

Subcontractors had to be found and when Spring came some 23 states had been tapped by the company's Purchasing Department. Over 3,000 firms in nearly 200 cities were sharing $80,000,000 worth of work.

August, 1942, 30 days ahead of schedule, saw the first Wildcat fighter hooked to a tractor and hauled to the company airport for ground tests. On November 11, 1942, as scheduled, the first torpedo bomber received and passed its initial flight test. The vanguard of an overwhelming force of carrier-borne aircraft to carry the battle to Nippon had made its appearance.

Task Force For Reconversion

THE TASK FORCE technique spectacularly employed in military operations, has its parallel in the work of production teams on the home front.

Task forces in the automotive industry—composed of a relatively few highly-skilled workers—prepared the way for the torrent of war materials now flowing from former motor plants at a $1,000 000 an-hour rate

And the huge reconversion problems to be dealt with call for the re-employment of this technique in the automotive industry So important is the work of industrial task forces in clearing the way for speedy rehiring of thousands of workers in converted industries that government agencies have already accorded work priorities to such personnel, ranking their assignments right behind war production and highly essential civilian output, but ahead of expansion and resumption of other civilian lines

A notable distinction has been made between pre-reconversion work, of the type to be carried on by industrial task forces, and actual reconversion, which comes after the initial work has been completed

ADVANCE PREPARATIONS

Pre-reconversion compares with the preparatory work of the military strategist It requires considerable time, exceptional skill, relatively few men, and it *must* be done well in advance of any actual changeover from one type of production to another Reconversion is similar to actual military offensive For this is the period which sees the plans and preparations translated into actions employing thousands of men

Time is an essential ingredient in preparing to achieve either military or industrial objectives. To reach the civilian production goal, certain actions must be taken six months in advance others three months in advance and still others thirty days in advance of the zero hour when reconversion operations will commence.

Here is the makeup of a representative task force in the automotive industry—men whose special skills and abilities must be brought into use before actual reconversion begins.

PRODUCT TECHNICIANS

The small group of men first released for the reconversion job are called product engineers They will study the last peacetime products of the industry and will decide what changes should be made in the forthcoming models From these decisions will spring the next series of questions which can be grouped under the heading, "How shall we make it?" At this point the process engineers take over

With 15,000 parts to consider in the average automobile, these technicians will review the manufacturing process of each of the parts going into their company's product Since most parts are closely related, changes in ten parts by the product engineers may result in changes in a total of a hundred parts altogether, as well as in several hundred revised manufacturing processes

At this stage, they must consider the thousands of suppliers of parts and subassemblies who served the company in peacetime, and must try to calculate how many of them can become suppliers again by the time the overall assembly process is ready For those who will not be ready, alternate sources must be found

Meanwhile, investigation must be conducted into the usability of new materials and of materials which can be substituted for those still on the critical list. Research must seek out the strong points and weak points of these materials, and must devise substitutes for those which are found unsuitable or which are now unavailable

Even while the plant hums with war production, plant layout engineers will begin to plan tentative arrangements of the machinery to be used in civilian production The company may have 50 000 machine tools engaged in war work, and 5,000 prewar tools packed in grease in storage The potential peacetime value of each of the 50,000 tools and their availability must be determined in advance the 5,000 stored tools must be rehabilitated and readied for active production work

The amount of plant space to be released for civilian production or to be acquired elsewhere, must be determined The layout engineers then assign theoretical positions to the available machines, using a layout board, comparable to a relief map used by military strategists

This operation is performed on the basis of known requirements at the time The tool engineers determine the order in which machines should be placed for the most efficient progressive manufacturing operations Next, the materials handling specialists study the production lines with relation to the flow of materials through the plant. The standards department indicates the number of men required to operate the machines, so that suitable areas for operators are arranged.

LAYOUT ENGINEERS

Plant engineers then view the projected layout with an eye to servicing the production lines with power, light, gas, water, and ventilation Finally, the personnel department checks the layout against the company's safety health and sanitary standards The layout engineers now have before them the interior design of a mass production plant, with production lines drawing materials in at one end and discharging them as finished parts at the other end

These production lines consist of individual machines, ranging in size from small lathes to giant presses costing $150,000 each or more After ascertaining how many war tools can be adapted to peacetime operations, and how many prewar tools can be rehabilitated, there remains always a number of important tools that must be bought or made If these few tools are missing the entire production structure is bound and helpless

If the new production set-up requires 5,000 tools for turning round metal pieces, 8,000 machines for drilling, 4,000 grinding machines, 2,500 machines for cutting gear teeth, 2,700 presses for shaping cold metal, 500 forging machines for shaping hot metal, and additional thousands of miscellaneous machines, no end-product can be produced in volume unless and until all of those machines are obtained, set in their proper places on production lines, and each pronounced ready to do its specific job

Having found which machines are missing from the projected set-up, orders for them are drawn up at once, since the manufacture of some may require up to six months or more

PRODUCTION CONTROL

The total of machines and materials needed, plus the materials to be handled in production goes through the production control department, and then to the purchasing department Orders for items like heavy machine tools are readied as far in advance as possible, and placed as soon as wartime restrictions permit

If it is found necessary to raise the plant roof, tear out the floor, rip out conveyor systems and replace them with new ones, this activity is calculated in advance, and consideration of the time it will take is given in figuring the other aspects of the plan

Once materials, parts and subassemblies begin to arrive at the plant, the machine tools must be set up and ready for operation The materials control men meanwhile are prepared for this continuous flow of supplies They route each semi-finished part, each pound of metal from the receiving dock through a battery of machines and a sequence of processing operations. Then the flow begins to converge on a final assembly point Now, many months or even several years after the first of the industrial task forces began their work, actual production of an end-product begins

The old and the new: bulldozers replace elephants on road jobs in Burma.

The Bulldozer, a Plowshare Gone to Battle, Blazes Victory Trails Around the World

"THEY *shall beat their swords into plowshares, and their spears into pruning-hooks; nation shall not lift up sword against nation, neither shall they learn war any more.*"

In this, the fourth year of America's participation in World War II, evidence accumulates on all fighting fronts to indicate that this productive nation's most potent weapon against the destructive might of the Axis may well turn out to have been a tool which is at least a partial fulfillment of Isaiah's prophecy.

This weapon is a plowshare. Its name is "bulldozer." Mounted at the front of a track-laying automotive vehicle, this peculiarly American construction tool is rapidly becoming the inanimate hero of this war.

A military road is born in Europe.

The "dozer"—as its operators call it—clears the ground and moves the earth for the swift and vast transportation of men and machines and materials with which American mass-productive might has enabled the world's freedom-loving peoples to cave in the bastions of the Axis' plundered empires. First arrival on the beachheads, blazer of trails through jungle and tundra and swamp, ground-clearer for air-power's landing fields and runways and fuel tank parks, road-builder amid the rubble of war-devastated cities, this mechanical workhorse has become the world around a token of the American people's prowess as trail-breakers; a sign of their deep and abiding faith in a way of life symbolized by the plowshare and the pruning-hook rather than the sword and the spear.

In the skilled and calloused hands of its operators, who call themselves "cat-skinners," the 'dozer has given many unforgettable demonstrations of the American worker's amazing capacity for getting work done speedily and easily with labor-saving power-tools—given them to peoples in lands where, until it arrived, all work had always been done slowly and laboriously, mainly with the primitive power of human and animal muscle.

Chief reason for the 'dozer's emergence as the mechanical hero of this conflict is that this war is, like most of history's wars, a fight for roads. As Lieutenant William Bradford Huie, C.E.C., U.S.N.R., has pointed out in his book, "Can Do!—The Story of the Seabees,"* at least five ocean-spanning "victory roads," the longest highways ever attempted, had to be built before the industrial power of the United States could be brought to bear against the enemies.

Spear-heading each of these enormous road-construction projects was the catskinner (either Navy Seabee or Army engineer), advancing, behind his shining shield, on a fire-breathing charger whose ancestors are the automobile and the farm tractor and whose relatives are the tank, self-propelled gun, and all motorized combat vehicles in their multitudinous varieties.

On all of these roads, the 'dozer and its automotive relatives — the trucks, trailers, power-shovels, cement-mixers, and other motorized earth-moving and pavement-laying machinery which Americans developed in peacetime—paved the way for all transportation, whether by land, sea or air.

On the North Atlantic road, for example, unprecedently huge areas had to be leveled and paved in Newfoundland, Iceland, North Ireland and England to bring the weight of U. S. air-power to bear on Fortress Europe. That accomplished, this road had to be enlarged with highways, docks, parking lots and fuel storage parks for the invasion of Normandy. Later, the highway was extended and expanded through France, Belgium, the Netherlands and into Germany.

Similar work had to be done on the

*Published by E. P. Dutton & Co., Inc.

"Cotskinning" on the Pacific Highway.

South Atlantic road, from the United States through the Caribbean to Africa —the highway whose later extensions radiated to Sicily, Italy, France, the Near East, Iran and Russia, and toward the Orient.

Into the greater distances of the Pacific, the road-construction operations had to be divided into three enormously long highways. Here, the automotive trail-blazers pushed northward toward Asia via Alaska and the Aleutians, while others thrust westward from Pearl Harbor in two great arcs, now joined in the Philippines and the Ryukyus at Japan's doorstep.

The first of these southern roads, begun when Japan was at the peak of triumph, looped southward, from island to island, to Australia.

From its terminal points at Sidney and Brisbane, the 'dozer blades carved two transcontinental roads to Darwin and Port Moresby. Later, a side road was pushed northwestward through the Solomons. Still later, this was augmented by the Pacific highway, from Pearl Harbor to the Marshall and Gilbert Islands, which divided into two routes around Truk and the Carolines.

The southernmost of these Marshall-Gilbert roads carried American production westward to give weight to the drive along New Guinea's northern shore toward Palau. The northern branch thrust westward through Kwajalein, Eniwetok, Saipan, Guam, to a juncture with the southern routes at Palau, and thence toward Leyte and points west and north.

At the terminus of each of these roads, the uniformed catskinners of our Armed Forces are at this moment pushing their motorized plowshares into the rubble of destruction and smoothing a way for more extensions of this, the greatest highway construction project of all time.

(*Part II appears in the next issue*)

AUTOMOTIVE WAR PRODUCTION

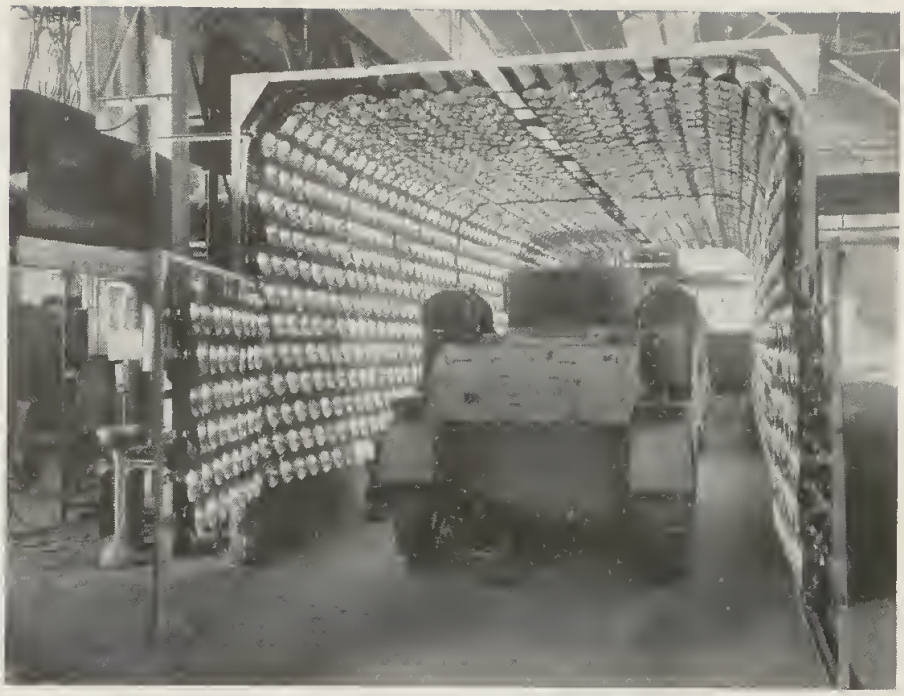
Published by

WAR PRODUCTION INFORMATION DEPARTMENT

Automotive Council for War Production

GEORGE H. CUSHING, Editor

New Center Building, Detroit 2, Michigan



Developed in 1930, infra-red lamps are an important aid in stepping up war output.

Automotive Plants Utilize Unusual Techniques To Improve Products and Step Up Deliveries

Development of a metallizing process to protect aircraft engines . . . a method of shrinking parts by liquid oxygen . . . new applications of infra-red ray heating lamps. . . .

These are just a few examples of the blending of science with the daily grind of volume war production in the automotive industry. The successful application of peacetime methods of research pays off in wartime as motor plants continue to step up operating efficiencies; resulting in improved products, made at less cost and with longer life, while at the same time freeing manpower for other pressing war jobs.

Illustrative of this, there is a metallizing process which increases the life of engines used in aircraft. By applying a thin coating of aluminum, .002 to .004 of an inch thick, to cyclinder heads and barrel assemblies, protection is provided from the effects of corrosion caused by extremes of weather and the elements.

In operation, aluminum wire is vaporized by a special machine and fed as a fine spray through a gun under pressure of natural gas and oxygen. The process is not unlike the method of spraying paint on metal surfaces which had wide application in peacetime production of motor vehicles.

Resembling a soft drink vending machine, a combination refrigerating and dispensing unit has enabled a motor company to cut in half the time required to assemble 36 tappet guide inserts in each 2,000 horsepower bomber engine it manufactures.

Chilled to 300 degrees below zero with liquid oxygen, the tappets shrink from two to three thousandths of an inch, and drop into place in the engine with ample clearance, expanding to proper size as they warm.

Infra-red lamps, developed by another company in 1930 to dry paint quickly on motor vehicles, have been adapted in wartime to dry enameled, varnished, oiled, lacquered, and waxed surfaces of various materials.

Savings in cost, time and man-hours over other forms of drying are tremendous, company engineers report. For instance, synthetic enamel can be dried in from two to four minutes under infra-red lamps equipped with carbon filaments and gold-plated reflectors. By contrast, a conventional gas oven requires from 15 to 45 minutes to complete the same operation.

PICTURE CREDITS: Page 6—top and lower left photographs were taken by the U. S. Signal Corps.

Many Hard-to-get Household Items Help Motor Plants Produce Weapons

AMERICAN housewives will probably be surprised to learn that many hard-to-get essential household articles have been drafted by ingenious automotive technicians to aid the industry's output of weapons.

Here are just a few examples of the way motor plants are utilizing such important household necessities as Lux, Spry, pipe cleaners, cleansing tissues, sewing needles, rubbing alcohol and scrub brushes.

At one company, a machine operator thought that Spry might make an excellent lubricant for her honing machine in the valve guide department. It worked, and as a result, 324 pounds of Spry have been used during the past year by this one department.

Lux is now being mixed with water to form a grinding solution because it assures a good finish on the produced part and because it keeps the grinding wheel from retaining harmful abrasives.

Pipe cleaners are important tools in the inspection and cleaning of aircraft valve guides, knuckle pins and tappets manufactured by several automotive companies. Last year one producer alone used 50,000 pipe cleaners to clean out tiny oil holes in the small but vital valve guides.

In the manufacture of an aircraft engine part, tiny blind holes which had to be neatly cleaned were causing plenty of headaches. Slender shafts of steel inserted into the openings were breaking or were incapable of whirling cleansing cloth to the degree required.

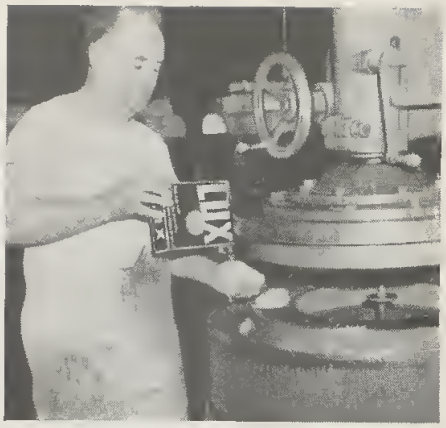
An employe at one company suggested that darning needles be inserted into a chuck, with a small strip of cloth threaded into the eye, and then revolved on a machine. Because it worked the complete stock of needles in two large department stores was bought out.

Cleansing tissues have been hard to buy for some time now, and it is small wonder! In the past 12 months, one company has used 17,280 boxes for wiping aircraft parts. Cloth was found to be impractical because it was less absorptive and because it scratched the highly finished surfaces. Furthermore the tissues have a double use; first to clean parts, after which they are thrown into a basket and used at the end of the day to cleanse inspection apparatus and machines.

Recently, a machine operator in a motor plant adapted another common household tool to a new use. Installing a scrub brush on the moving part of a broaching machine, he cleaned the chips from the cutting tools automatically.

Another common household item, rubbing alcohol, is mixed in great quantities with dry ice. Temperatures from 100 to 105 degrees below zero are obtained and the mixture is used in heat treating and hardening operations to age steel and to control structure.

To round out the listing, boroscopes and otoscopes, those cavity lighting instruments used by doctors for ear, eye, nose and mouth examinations, now penetrate the dark and difficult-to-reach holes of many aircraft engine parts, permitting careful, exacting inspection.



Automotive WAR PRODUCTION

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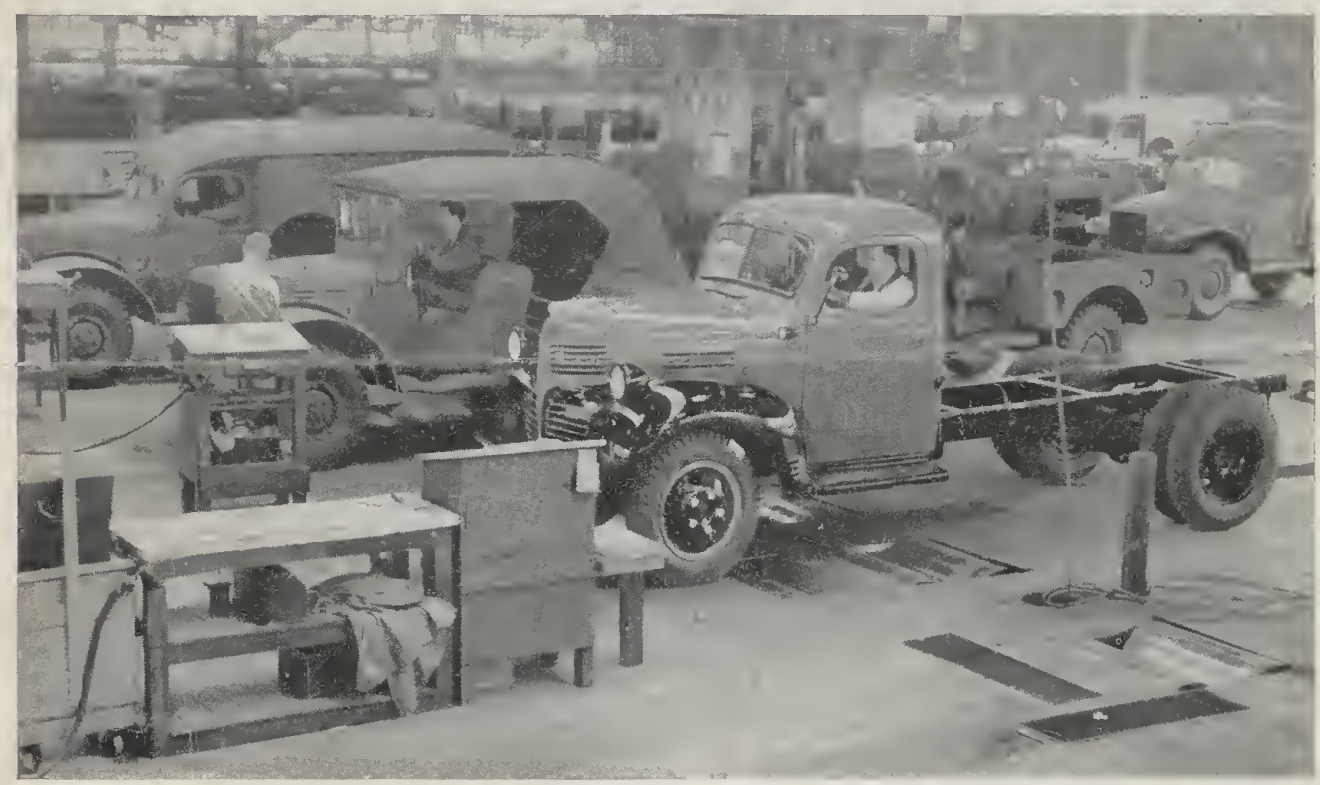
Automotive Industry Planning for "Two-Front" Job



Combined operotions: Continuing the flood of wor goods is the industry's No. 1 job. Limited civilion output ronks next.

Plants Starting Passenger Car Reconversion While Still Carrying Heavy Military Load

UNDERTAKING a job of combined operations—production for war and for civilian needs—the automotive industry in the summer and fall of 1945 faces a tremendous challenge to its ability and ingenuity.

When the official "green light" flashes July 1 for resumption of automobile production on a limited basis of 2,146,786 cars for the coming twelve months, it will provide the go-ahead for intensive efforts to recreate a productive system which was completely destroyed nearly three-and-a-half years ago.

Simultaneously, the motor truck industry will start on a program of doubled civilian production for the last half of 1945. At the same time, output of replacement parts for automotive vehicles will be starting in quantity.

Yet, production for the Japanese war has first call on the motor industry's resources, facilities and manpower, with indications that many tough, complex war production assignments will remain with automotive plants so long as needs are critical.

At the close of 1945's first quarter, the automotive industry had *ten billion dollars* of war work yet to perform. Since that time military services have cancelled or cutback a number of war orders, so that the backlog has been lowered to an undetermined amount.

The availability of raw materials and of manpower, brought about by reduced military schedules, provided the

(*Continued on Page 6*)

Products from o half-million acres go into the building of every million outomobiles.

Partnership of Motor and Farming Industries Embraces the Efforts of 17-Million Workers

FIRST to accept the motor vehicle as a necessary tool was the American farmer.

Stressing this often forgotten fact in his book, "Combustion on Wheels,"* David L. Cohn observes that this early acceptance knocks into a cocked hat the still prevalent notion that the city slicker is by nature a bold and venturesome fellow who will try anything once, whereas his country cousin is by nature cautious, conservative and slow to change.

Long before the city slicker stopped thinking of the automobile as, by turns, a passing fad, a rich man's toy, a luxury, a pleasure car and finally a necessity, the farmer evaluated it correctly, as a device that would aid him in his ancient and unequal contest with the inexorable demands of time and nature.

From the beginning, when the automotive industry was called "the motor game," there has been a spectacular business and social partnership between the men who make the automotive industry's production system tick and the men who make the Nation's agricultural production system work.

For in the years prior to the cessation of civilian passenger car and truck production more than 17,000,000 American workers, better than 10,000,000 on the farms and over 6,500,000 in the production and use of motor vehicles, were embraced directly in the partnership's operation.

Before the war, the production of motor vehicles was one of the largest markets for farm produce. In a typical year a minimum of approximately $35,000,000 worth of corn, cotton, hides, turpentine, wheat, as well as many other agricultural products were purchased by motor vehicle makers to go into cars, trucks, buses and their parts.

Estimates have been made that farm products from a half-million acres are used in the building of every million automobiles. For instance, one bale of cotton out of very 10 consumed in the United States goes into products made by the automotive industry.

Here are some other farm commodities purchased by the motor industry in peacetime production years:

Wool for upholstery and floor coverings, 16,640,000 pounds; *leather,* 21,156,000 square feet; *sugar* cane, 12,500,000 gallons of molasses for solvents; *tung oil,* 800,000 gallons; corn for starch, alcohol, paints and varnishes, 2,800,000 bushels; *soybeans* for 1,500,000 gallons of oil, in addition to other soy products in plastics; *flaxseed* for paints and soaps, 590,000 bushels; *hogs* for fats and hair, 36,000; *castor oil,* 2,000,000 pounds; *turpentine* for paints, 4,828,000 pounds, or about two pounds for each vehicle produced.

One automotive company estimates that to supply the cotton for upholstery used in its products, nearly 20,000 farm workers were needed annually.

Another firm reports that for its products what was needed was cotton from 433,125 acres; wool from 801,000 sheep; leather from 30,000 cattle; flax from 17,500 acres; corn from 11,280 acres; mohair from 87,500 goats; beeswax from 86,000,000 honey bees, and a long list of other items.

But that is only the beginning of the automotive-farmer partnership. For, in return, one-fourth of all the trucks and one-sixth of all the automobiles manufactured and sold in America are purchased by farmers.

Of far greater importance to the farmer, however, is the consuming power of the millions of people who earn their living from automotive activities; manufacturing, sales and service, truck and bus driving, filling station establishments, taxi drivers, and scores of other occupations. With a total estimated 1940 income of $7,233,000,000, these people represented a huge segment of the national buying power, and to a considerable degree determined the income of farm families by their yearly food and clothing requirements.

*Published by Houghton, Mifflin Co.

War Production Briefs . . .

One former motor vehicle manufacturer has built and delivered to the Armed Forces 17,500 tank engines.

* * *

Over a half million M-3 submachine guns have been manufactured by a company whose peacetime product was motor vehicle lamps. These ten-pound weapons, many of which have been dropped by parachutes from aircraft to European underground forces, fire at the rate of 450 shots a minute.

* * *

The tenth tank model of the war is now rolling from the assembly lines of a company which once turned out passenger cars and trucks. Beginning in 1940 with manufacture of the M-3 "General Grant" medium tank, which helped the British halt the Germans in North Africa, its subsequent model changes include a revised M-3, six types of the M-4 "General Sherman," one undisclosed design, and the powerful new T-26 "General Pershing."

GIs Who Have Lost Limbs Will be Able to Drive With Aids Developed by Automotive Engineers

THIS story is for disabled GIs only. Particularly for those who will come out of military service minus one or more of their limbs.

Everything possible is being done in the automotive industry so that you will be able to own and drive an automobile safely again.

With the aid of a few easy-to-manipulate devices attached to the steering wheel post, the dash board or the foot pedals—depending on the type of disability—you'll find it handy to use your car for driving to work, shopping, vacations or in handling your day-to-day affairs, just as you did when you owned an automobile before you entered the service.

These driving aids will fit on either the car you left behind or the car you plan to acquire. Most important, these special devices will not interfere with other members of your family who want to drive the car.

The special equipment which makes this possible is the result of research and actual driving tests carried on over recent months as a cooperative effort of the Army Surgeon General's staff, the Society of Automotive Engineers, the Automobile Manufacturers Association and the American Association of Motor Vehicle Administrators.

In the accompanying picture you see the interior of the test car, fitted out with all the driving aids developed during the course of the program. Actually, no passenger car will ever need to be so fully equipped, and vehicle control installations will be tailored to meet individual requirements. But, from this master set, driving aids to accommodate scores of combinations of limb amputations may be installed on any make car.

During experiments to determine the practicability of the control devices, the test car was successfully operated by veterans who had lost from one to three limbs.

For example, a veteran with both legs amputated above the knees needs the following special hand-operated devices: light dimmer switch, throttle, starter button, accelerator and power brake control. Should a veteran lose his right arm above the elbow and his left leg above the knee he would require these special devices: gear shift lever on left side of steering wheel, knob attached to steering wheel for steering, hand operated light dimmer switch and clutch pedal bar or vacuum controlled throttle.

The need for developing aids to help disabled veterans drive motor vehicles was placed before the automotive industry last summer. To meet it, every manufacturer named a representative to a newly-formed SAE technical committee and the group attacked the problem from these three angles:

First, a survey was made of all car companies and accessories manufacturers to determine what mechanical aids existed that might be made available quickly; secondly, a study of problems presented by World War II was carried on; and, finally, studies of possible new devices and mechanical attachments which would further help the disabled veteran drive with safety despite artificial arms or legs came under the engineering searchlight.

Presented to the Surgeon General, the automotive industry report received his enthusiastic blessing, and, at once, the facilities of Percy Jones General Hospital, Battle Creek, Michigan, were made available to the SAE committee for field tests. And here the new devices developed, or the older ones that had been used in peacetime were refined and subjected to the critical analysis of the patients.

Additional problems attached to the use of the hand controls, such as drivers' licenses for legless veterans and automobile insurance, also are being solved by the SAE committee.

To date, 36 of the country's 48 secretaries of state have indicated that their licensing bureaus will grant drivers' permits to disabled veterans who have automobiles equipped with the necessary controls.

In Michigan, where actual driving tests have been conducted, licensing officers are enthusiastic about the skill displayed by handicapped veterans in handling cars in all kinds of traffic, the SAE committee reports.

No veteran will need *all* the devices shown in this test car to drive safely.

B-29s are serviced even as construction at an airbase in the Marianas proceeds

THE BULLDOZER — PART TWO

Pacific Highways Are Pushed Across Trackless Island Wastes, Straight Towards Tokyo's Heart

"The robomb may stand for Germany, the hara-kiri sword for Japan, the Spitfire for Britain, but for America the proper symbol of war is a symbol of peace—the bulldozer"

This observation by Professor William S Lynch, head of the Cooper Union Engineering School's Department of Humanities, is an apt expression of what many men of our nation's armed forces have come to believe The Army's Engineers and the Navy's Seabees both insist that the United States has developed only three important secret weapons in this war the jeep, the duck and the 'dozer

Since the personnel of these two forces is drawn chiefly from such peacetime occupations as are involved in construction of highways railways, bridges, docks, dams, pipelines, airlines, electrical-transmission lines and other communication and transportation media, there is a marked tendency among them to rate the 'dozer first in the order of importance

This tendency can be expected to become more pronounced now that the war in Europe has ended and the flow of much of the traffic has to be reversed to move the weight of America's productive might around to the opposite side of the planet For, as the Army and Navy's construction and transportation experts have indicated the time required to defeat Japan will be largely determined by the speed with which men and material can be moved into the Pacific theaters of operations That movement will have to be borne by the Pacific highways shown on the accompanying map

As the map indicates, it is a high way building program in which the needs change rapidly The southernmost road begun when Japan was at the peak of its triumph, has diminished in importance as construction of more direct highways became possible farther north. Because it *is* a constantly changing highway network, the 'dozer and other earth moving and road building machinery will continue to rate high in the order of importance

On Guam, for example, one of the world's finest four-lane superhighways was constructed within a few weeks after the island's recapture last July

In support of their top rating of their favorite "weapon" the Seabees like to point out that, as far as is known, the first American motor vehicle in World War II to land on the continent of Europe was the 'dozer that Seabee Machinist's Mate Raymond J Calhoun tooled down the ramp of an LST onto the beach at Salerno, when the invasion of Italy began.

If that fails to convince doubters, they point to the record of a battered veteran of the Pacific called "Old Faithful," whose treads have churned up the beaches of at least six different islands on the road to Tokyo and whose blade will clear the rubble of that city's Ginza if "Old Faithful's" custodians can carry out their plan

That plan, they say, is to roll "Old Faithful" down the ramp of the first landing boat to hit the beach of the Nipponese homeland and to "prepare a nice smooth way so the Marines can land and stage a parade.' To that end 'Old Faithful" has been nursed and pampered by the mechanical doctors of at least half a dozen Seabee battalions, and its innards have been patched with so many improvizations that it is said to function entirely on "parts made of baling wire stuck together with Copenhagen snuff"

Innumerable battlefield legends have grown up around the bulldozer Hero of one tale is Aurelio Tassone a quiet young American machinist of Italian ancestry, who came to the Navy from a factory job, in Milford, Mass., and became a cat-skinner in the 87th Seabees Battalion.

On the morning of October 27th, 1943, one hour after the beachhead landing of our forces on Mono in the Treasury Islands southwest of Bougainville Tassone, engaged in jungle-clearing operations for construction of docks, airport and highways, came upon a job for which his 'dozer had not been designed In his performance of that unusual task, Aurelio made history by becoming the first to use a 'dozer deliberately as a deadly weapon

The progress of the landing party and the construction operations were being held up by a Jap-manned pillbox whose gunnery was raising havoc among the attackers on the beach Sizing up the situation, Aurelio maneuvered his 'dozer to a difficult angle of fire for the Japanese and, while a rifle platoon under Navy Lieutenant Charles E Turnbull concentrated its activities on the apertures in the pillbox, put his machine into low gear and moved it slowly toward the obstacle.

To protect himself, he raised the 'dozer blade, using it as a shield As he rolled ponderously forward, machine-gun slugs rattled off the blade At the proper second, he dropped the blade quickly, curled a slice of earth over the aperture and, continuing to the top of the bunker, crushed it with his twenty-ton machine Later, twelve bodies and a large, new gun were exhumed, along with a setter dog which was alive and unhurt Tassone was given the dog and a Silver Star

This American boy's ingenuity supplied the germ of an idea for a new weapon that saved many lives in France less than a year later This was the tank-dozer, a ponderous armored plow which Army Ordnance developed in time to enable it to end the deadly stalemate in the Normandy peninsula

After initial landings of our invasion forces in that part of Europe, the Nazis worked out an ingenious defensive technique whereby their slowly retreating forces took full and murderous advantage of the fact that all Norman farms are surrounded by dense hedgerows, all of which could be easily converted into machine-gun nests. Just as the action threatened to deteriorate into the deadliest of battle forms, war of attrition, the tank dozer appeared

A three-and-one-half-ton blade mounted on an M-4 medium tank, it butted through the tangled hedgerows and plowed under the murderous defenders Then crashing through the enormous reinforced concrete dragon's teeth the Nazis had built to stop tanks, it played an important part in the break-through at St. Lo which marked the beginning of the end of the Second Battle of France

In historical perspective, the bulldozer is nothing more nor less than an ingenious combination of a number of useful tools, the development of which has been powerfully aided down through the years of this nation's growth by the American people's natural inventive genius. These are the plow, with its earth moving variants, the automotive vehicle in its many forms, and the track-laying and related mechanical devices with which ingenious Americans have striven to make motorized vehicles perform useful work in every kind of terrain

The wartime usefulness of the 'dozer is a natural result of this nation's adoption of the automobile as a working tool and the consequent effort of the American people to lift themselves out of the mud with the finest network of highways in the world What the results of the wartime extension of these American ideas around the planet may be, no one can now foretell

(Part III will appear next month)

Men and supplies followed the bulldozers ashore in the Philippines.

Plants must be torn apart and restored before the first motor car is turned out.

Two-Front Job Planned by Automotive Industry To Meet Jap War and Civilian Production Needs

(Continued from Page 1)

basis for government permission to the automotive industry to prepare for civilian output.

Priority assistance was granted manufacturers in ordering machine tools and materials for plant reconstruction.

Yet, no priority ratings were granted for materials needed to make passenger cars. Manufacturers are to rely on their ingenuity and upon the ability of producers of textiles, lead, rubber, lumber and other scarce items.

Truck manufacturers, however, are to have the advantage of a priority rating (AA-2) on materials needed to turn out their doubled quota of civilian motor trucks, reflecting the government's feeling that truck production is more essential at this time than new automobiles.

The industry's attempt to switch back into limited civilian production is expected to be even more difficult than in converting originally to war production. Beside the necessity of carrying on "combined operations," the situation is complicated by myriad governmental controls over manpower, materials and equipment, which restricts the industry's freedom to solve its perplexing problems quickly.

The government has set 215,000 vehicles as the passenger car quota which can be produced between July 1 and December 31, basing this figure on the amount of steel it estimates will be available for civilian uses.

On this basis, one automobile company points out that its quota for the remainder of the year is equivalent to 10 days' normal peacetime production.

For the automotive industry as a whole, some 3,744,300 passenger cars were turned out by motor plants in the last full year of pre-war production. This makes the allotment for the first year approximately 43 per cent below the industry's 1941 output.

The number of new cars authorized for the next twelve months, measured against estimated demand, indicates that only one person out of every five or six who want new vehicles will be able to have his needs satisfied.

The Office of Price Administration has announced that it will ration new cars, at least in the initial months.

The same rules that have been applied throughout the war as to the essentiality of occupation of the prospective purchaser will continue.

Motor Plant Wages Top Other Industries

Annual Rate of Pay Now at $3,000 Mark

WORKERS in the automotive industry, long recognized to be among the nation's best-paid industrial employes, have continued to hold their position during wartime. Current average annual wages per employe are 46 per cent above those paid in the best previous peacetime year.

Latest figures compiled by the Bureau of Labor Statistics show that the average worker in the motor industry receives an income at the rate of $3,000 per year, nearly $700 more than the national average for all wage earners in the country.

Comparison on a United States dollar basis of wages paid British war workers and those paid American automotive employes offers considerable contrast. In Great Britain the average annual wage for all workers before taxes amounts to $1,400 while factory workers in the durable goods industries receive an average of $1,085 yearly.

No wartime wage figures are available for workers in other countries, since the conquests of Germany and Japan dictated income and production levels throughout a great part of the civilized world. But a look at BLS reports from Asia and Europe for the last year of peace points up the economic benefits brought to the American people by their system of free, competitive enterprise.

Translating foreign currency into American currency at the 1938 rate of exchange (the last rate reported prior to the war) shows that workers in highly industrialized Belgium, for instance, were paid from $7.20 to $10.08 a week as against approximately $30 then and $57.50 now for U. S. automotive workers.

In Norway weekly wage scales graduated from $10.44 to $22.56; Denmark's rates went from $16.62 to $33.84; France, $6.50 to $12; the Netherlands, $9; Greece, $3.30; China, $1.25 to $2.50; Thailand, $1.26 to $2.52; French Indo-China, $.66 to $2.76; and British Malaya, $3.60 to $6 (for skilled rubber workers).

PICTURE CREDITS: Page 4—Press Association, Incorporated. Page 5—Signal Corps.

Automotive Engineers Develop New Bearing

Longer Life Seen for Postwar Car Engines

PROVED by more than 500,000 installations in armored cars, weapons and personnel carriers, tanks, jeeps, cargo trucks and command cars, a new kind of bearing, developed by automotive engineers, promises longer life for postwar passenger car engines.

Described as a "tri-alloy" bearing, the improved product is approximately 40 per cent lead, five per cent silver, a small percentage of iron, and copper. Cadmium, used widely as a bearing material before the war, is the material replaced.

Because bearings ordinarily used in civilian vehicles, which operate most of the time at comparatively low loads, developed weaknesses under the high stresses imposed by military vehicles functioning at peak performances for many successive hours, automotive engineers began work to find a new bearing several months ago.

Already known to the engineers was the fact that single-face, copper-lead bearings were easy to make. But to turn out double-face or "floating" bearings, such as connecting rod bearings, was more difficult. Segregation of the lead was a big problem when coating both sides of the material at once because the process created weak points.

The technicians observed that segregation did not occur when silver was present. Sample bearings were made with this alloy and laboratory experiments as well as road tests totalling 50,000 miles demonstrated the superiority of the new bearings. Indications are that "tri-alloy" bearings last three times longer than regular bearings.

AUTOMOTIVE WAR PRODUCTION

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WAR PRODUCTION INFORMATION DEPARTMENT

Automotive Council for War Production

GEORGE H. CUSHING, Editor

New Center Building, Detroit 2, Michigan

"Stop and Shop" truck travels New England with full stock of replacement parts.

Itinerant Peddler of Colonial Days Recalled By Automotive Dealer's Mobile Parts Shop

OLD fashioned "Yankee ingenuity," which played so important a role in the commercial and industrial development of America, has been put to work on the home front by enterprising automobile parts and vehicle dealers to help maintain the nation's hard-pressed private transportation facilities throughout the war.

Latest example of its application to the automotive service business is in Worcester, Massachusetts. From this New England community, an itinerant motor vehicle, called a "stop and shop" truck by the parts distributor who developed the idea, travels throughout the state, bringing a complete line of replacement equipment for passenger cars and trucks to automobile dealer establishments, service stations and independent garages.

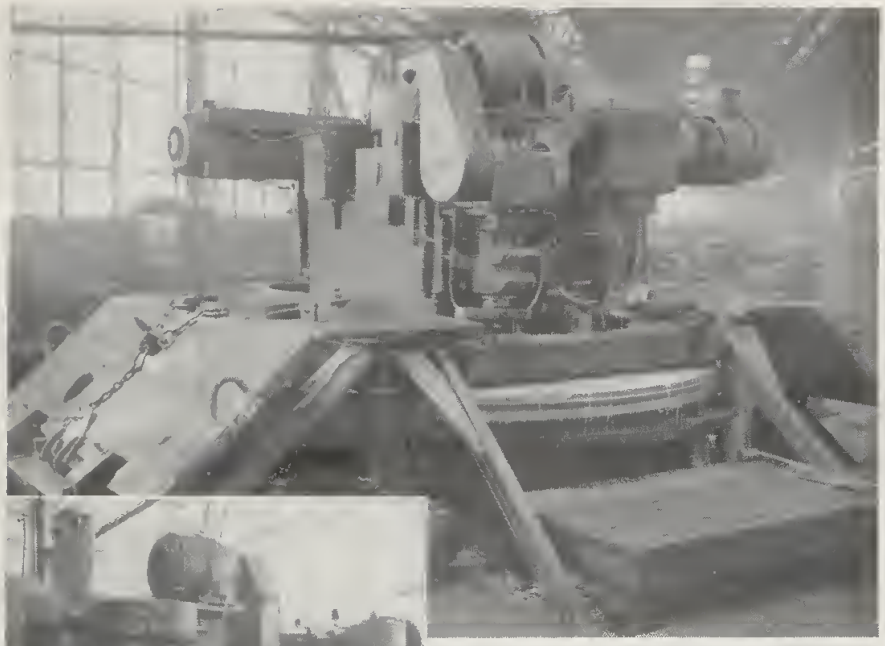
The vehicle is really a modern version of the colonial peddlers who once roamed the countryside in wagons, or with packs on their backs, carrying a diversified stock of merchandise. Like his motorized counterpart, the peddler was welcomed by his customers because he brought them needed items they would have had difficulty getting otherwise.

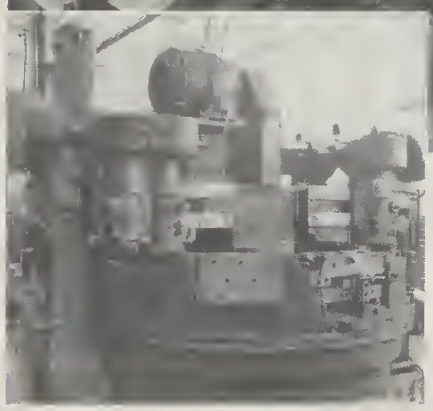
Built on a standard 1½-ton truck chassis, the "mobile parts department" consists of a special body fitted with banks of parts bins. Made by a Massachusetts firm to the dealer's specifications, the complete body cost in the neighborhood of $800.

On one side of the unit three wide doors swing out to give a full view of the stock bins. Across the top of each door is a sign, "How Is Your Stock?" and listed on the panels below are a dozen or more parts and equipment items. At the bottom, a smaller door opens into a compartment in which batteries are displayed, while deep inside the vehicle there is ample space to carry such parts as mufflers, tailpipes and fenders.

When the unit stops at an automotive retail establishment it is sure to get attention. Parts and service men come out to look over the stock and almost invariably are reminded of something they had forgotten to order or failed to realize was available.

Each night the vehicle's bins are refilled, and by 8 o'clock the next morning the truck is ready to start its itinerary with a complete stock. In addition to regular calls, the truck delivers telephone and mail orders which come into the home office.





Abave: Drastically "butchered" far the war job af milling tank parts, this machine is ruined far civilian work. It will be scrapped when hastilities cease.

Left: Before it was redesigned, the mill laoked like this. Its peactime functian was ta farm the taps and battams af passenger car engine cylinder blacks.

How to Adapt "Butchered" Production Tools Is Reconversion Problem for Motor Plants

THOUSANDS of machine tools which formerly shaped parts for peacetime passenger cars and trucks have become war production casualties, incapable of restoration for postwar use.

These are the machines which, shortly after Pearl Harbor, were torn apart, drastically redesigned and rebuilt to enable them to make parts for planes, tanks, guns, motor vehicles, naval equipment and other war products which could not be produced on the ordinary pre-war machine tools.

Known as "butchered" machines, many of them have been so changed in appearance and function that they bear little or no resemblance to their former state. When their wartime jobs are ended, only a small percentage will be worth reconverting, automotive master mechanics say. Because of their drastic modification and the extremely hard wear imposed on them by war production, many of them will be scrapped.

To replace them, orders bearing top priorities (right after orders for equipment to be used on the production of war material) have been recently let with machine tool builders; but deliveries are not generally expected until the latter part of this year.

How did such machines become so "butchered?" In the early days of the war, automotive process engineers, examining the blueprints of the needed armaments, quickly realized that special machinery would be required to shape most of the essential parts.

Normally, such special equipment would have been ordered from the machine tool companies, but time forbade. To speed the flow of weapons, master mechanics selected the machines which could best be adapted to the new war jobs. Working, in some instances around the clock, they designed new gears, cams, shafts, pulleys and other parts and had them turned out in the companies' own tool rooms.

One firm, equipped with 50 intricate gear generator machines used to cut the curved teeth of automotive hypoid gears and pinions, "butchered" 44 of these tools in order to produce in quantity an essential part for six-wheel drive weapons carriers.

The part required rotation as it was being machined by a cutting tool operating in three planes. Also, the cutting spindle was required to turn 300 revolutions per minute instead of 40 as formerly. Except for the main housings, these machines were redesigned and rebuilt virtually from the base up. Even their source of power was changed; formerly driven by a single belt, each is now operated by two electric motors.

In nearly continuous operation since April 1, 1942, these machines are nearing the limit of their life expectancy. Their original builders have recently indicated that new parts for reconversion will not be available for two years. Forty new machines are on order, and the 44 "war casualties" will be scrapped when the armed forces' need for weapons carriers is past.

Also radically modified were four huge rotary milling machines which in peacetime formed the tops and bottoms of engine blocks. For more than three years, three of these tools have been shaping loading mechanisms for Bofors guns. The fourth, altered almost beyond recognition, has been used in the production of tank parts.

To machine aircraft wing struts, two other peacetime milling machines were "cannibalized" to get one piece of equipment usable in war work.

The wartime use and ultimate fate of these machines is typical of what is happening to a small but important portion of the industry's 175,000 prewar machine tools. In addition, shortly after Pearl Harbor, some 13,000 other automotive machine tools were pulled from their bases, placed in an industry-wide pool where they were available to any motor plant looking for a particular machine to do a particular war production job, or were transferred to war work outside of the industry. Some were sent as far away as Russia, but all of this equipment must be replaced as quickly as possible.

In order to resume even partial production of automobiles, the industry must purchase from 4,000 to 5,000 new tools, costing nearly $50,000,000; it must get freed two-thirds of their remaining machine tools now used partially or full time on war work; it hopes to purchase from three to five per cent of the 165,000 to 175,000 government-owned machines installed in automotive plants during the war.

AUTOMOTIVE
WAR PRODUCTION

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During recent tie-up of commercial trucks in Chicago, Army equipment stood by to relieve critical shortages.

Truck Production Boosted to Meet Home-Front Needs

Motor Industry Given "Green Light" to Build 548,172 Commercial Vehicles by End of Year

MORE than two times as many commercial type motor vehicles as passenger cars are scheduled to roll off automotive production lines in 1945.

So essential are trucks in keeping food, raw materials, finished civilian goods, weapons for the Japanese war and other necessities moving smoothly between sources and consumers that the War Production Board early this month authorized commercial vehicle builders to turn out 126,000 more trucks this year than had been previously allocated.

With the new allotments, motor companies have now been given the "green light" to produce 548,172 trucks, ranging in size from lightweight delivery trucks to the giant off-the-road vehicles used in mining and forestry.

At almost the same time the WPB was authorizing the automotive industry to step up truck production, the commercial vehicle's function in the civilian economy was being sharply emphasized in Chicago.

Here, for the second time within a month the nation's number two metropolis and the far-flung area which it serves were paralyzed when trucking services were partially denied the city for a period of approximately 10 days and nights as the result of a recurring labor dispute.

To a community which counts upon trucks for 66 per cent of its eggs, 50 per cent of its poultry, 56 per cent of its butter, 28 per cent of its cheese and 20 per cent of its fruit, the two tie-ups revealed, forcibly and dramatically, the vitally important role of commercial vehicles in providing the day-by-day necessities of life.

They pointed up also how all forms of transportation in this highly integrated nation—highways, railways, airways and waterways—combine into an inter-related, coordinated conveyor-line network, the failure of any one link of which causes the deterioration of the whole chain.

The first strike lasted only a week, but its effects were felt across the country. At the start only about 15,000 of an estimated 70,000 trucks operating in Chicago were involved. Nevertheless, conditions caused uncounted hundreds of out-of-town drivers, Chicago-bound, to halt their vehicles at the city limits and park there or return, loaded, to their

(Continued on Page 7)

"Bedside" course teaches a veteran the secrets of automative carburetian system.

Automotive Industry's Rehabilitation Courses Help War Veterans Prepare for Civilian Life

PROBABLY the last place you would expect to find a fully equipped, automotive-type tool shop is in a United States Army General Hospital.

Yet, in the Percy Jones Hospital at Battle Creek, Michigan, such a manufacturing establishment is now in operation, manned by wounded and handicapped combat veterans of the war against Japan and Germany.

Its products are items that can be used by other disabled soldiers, many of whom are bedridden, or by the hospital itself in the work of rehabilitation that goes on 16 hours every day.

Paid for and equipped by the concerns comprising the Automotive Tool and Die Manufacturers Association, the shop is the latest example of a cooperative veterans' reconditioning program being conducted by the Army's Surgeon General and the automotive industry.

The program has a threefold purpose. First, to give occupational therapy to wounded soldiers; secondly, not only to help restore health, but to give needed recreation; and thirdly, to provide mechanically minded men with valuable training for the time when they will return to civilian life.

A car's electrical system is studied.

Housed in two buildings, each 51 by 58 feet in size, the shop contains all new equipment, equal to the best that can be found in any motor car or tool maker's plant. To furnish the machinery and tools, the Automotive Tool and Die Manufacturers Association asked its members for cash contributions of $20,000. The members, however, voluntarily made gifts of an additional $30,000 worth of production equipment.

The shop is not run on a shift basis as would be an ordinary plant. Rather, morning and afternoon classes are held during which instruction is given and projects worked out. At present 60 to 80 wounded veterans are attending each session, which are presided over by army and civilian instructors experienced in practical tool shop work. As an added feature, members of the Tool and Die Association give weekly lectures on shop practice to the wounded men.

In building number one, the veterans have at their disposal five lathes, four tool grinders, three drill presses, two shapers, two milling machines, one cutter grinder, one cut-off saw, one band saw, three sets of the famous Johansson Gauges, as well as micrometers, measuring gauges and other precision inspection equipment.

Adding realism to the courses is a tool crib at one end of the structure where small tools are checked in and out, just as in a regular plant.

The second building is fitted out with a wood shop for pattern making and with engineering rooms where such subjects as blueprint drawing and tool design are taught and practiced. As additional money is raised, the association plans to install heat treating and metallurgical departments.

Another unique veterans' reconditioning program now in operation on a nationwide basis is a "bedside course in motor mechanics."

The program is designed for patients who are immobile and is sponsored by an automotive company which furnishes all the equipment. Each soldier enrolled in the training course receives a special kit. In it he finds a set of tools and the actual parts of smaller units of motor vehicles such as the carburetor and electrical equipment, as well as instruction manuals.

In addition, the company has developed a mechanics' training course for ambulatory cases, those patients who are able to move about even though handicapped by splints and casts on legs or arms. It includes classroom work on the lighter motor car parts and comes complete with text books, charts, and other educational aids.

War Production Briefs . . .

Of the 4,132 World War II veterans employed by one motor company, 1,616 are listed as having worked with the firm before joining the armed forces.

* * *

One pre-war manufacturer of passenger cars is now making wing sections for the Navy's newest carrier-borne dive bomber, the SB2C-4. This powerful airplane carries 20-millimeter cannon and wing rockets as well as bombs.

* * *

The 45-ton "General Pershing" tank, said to have been one of the principal factors in the break-through of General Patton's armor to the Coblenz region and in the capture of several other important Rhine River bridge areas, is largely an automotive product.

Two companies, formerly competitors, produce the vehicles. A third, also a peacetime competitor of the other two, supplies the special engine which gives this tank greater mobility than any other power plant previously used in U. S. tanks. Scores of other motor vehicle and parts plants are subcontractors in the industry-wide program.

Generol Pershing tonks ore battle-tested on outomotive proving grounds.

Automotive Proving Grounds Given Pummeling As Military Vehicles Are Rigorously Tested

WAR has pummeled the automotive industry's proving grounds.

Beautifully landscaped hills now bear the "hoof-prints" of Mars' modern cavalry. Smooth pavements have been broken and rutted by heavy military vehicles. Big motors roar day and night, and guns boom in the air intermittently, having replaced during the war the soft purr of well-tuned motor car engines.

But in the process of pounding the proving grounds incessantly and literally wearing out military vehicles under tests, automotive engineers found out how to give American fighting men the best weapons possible.

On three representative proving grounds, whose combined total area is slightly more than four square miles, military vehicles have been put through rigorous road tests of nearly 2,500,000 miles in 36 months. This distance is equivalent to nearly 100 trips around the world at the equator.

Throughout the war the industry's proving grounds have been under exclusive contract to the United States Army Ordnance Department, which wished to take advantage of trained personnel, scientific testing equipment and such practical facilities as roads, dirt trails, steep grades, sand pits, water basins and deep mudholes.

In typical tests, tanks, trucks or scout cars roar over the highways, rip through axle-deep mudbogs and climb hills scarred with "shell holes." Sometimes vehicles are sent up a 60 per cent grade, so steep a man is unable to walk it without rubber-soled shoes. Yet, the weapons under test must go part way up, come to a dead stop, hold with their brakes, and then pull themselves to the top. To complete the test, the vehicles come down the hill and go up again, this time in reverse gear.

As a grand finale, vehicles are put through a 5,000-mile endurance trial over all the roads and obstacles provided by the proving grounds.

When this test is completed, the vehicles are torn down and each piece is labeled. Then each component is photographed and measured to determine wear. The tear-down operation is done with the vehicle's own tools to make certain that they are satisfactory for emergency repair work once such vehicles reach combat areas.

One proving ground has completed to date more than 1,500 tests on a total of 900 combat vehicles. These ranged in size from a two-wheeled, single cylinder motorcycle-type vehicle weighing 430 pounds to a giant tank recovery unit. When loaded with a General Pershing tank the latter unit weighed 176,600 pounds.

Specializing in endurance type tests, another proving ground has performed 505 projects out of 607 assigned to it. In these tests, vehicles were operated for 518,000 miles and consumed 770,000 gallons of gasoline.

As the result of proving ground work, the efficiency of American combat vehicles has been stepped up many times. Typical are these improvements: a new type of springing for tanks which permitted the widening of treads from 16 to 23 inches; a 500 per cent increase in the life of clutch bearings used in medium and light tanks.

High School Students Train for Plant Jobs

ANOTHER "first" in the field of industrial education is credited to the automotive industry.

A leader for over 25 years in the job-training of workers and management personnel through company operated schools, the industry a few years ago established specialized cooperative courses in shop practice for high school students. The courses were aimed at preparing young Americans for their future roles in the manufacturing side of industry.

Success of the program has led to the next logical step: a one-year cooperative course in general office work for senior high school students.

When presented recently, the plan was enthusiastically welcomed by school authorities, and arrangements were made whereby students, in alternate two-week periods, could divide their time between regular classes and an automotive company's offices.

In the offices, the trainees work from 8 a.m. to 4:45 p.m., six days a week. They are paid uniform, prevailing salaries, and earn overtime premiums after the first 40 hours.

Twenty-six girls and two youths, averaging just under 17 years of age, now are enrolled in the course. In order to acquire a high degree of proficiency in the many phases of office routine, the students work regular periods in various company departments, learning the practical side of accounting, time study, sales, safety, planning, payroll, educational activities and the duties of supervision.

Upon graduation they are free to enter college, seek work elsewhere or continue with the company as a regular employe; but there is no obligation on the part of the students to remain.

Focusing The Camera
in the motor industry


1

As practiced by automotive plants, photography is far from a hobby and much more than an art—it is one of the most important tools used in creative and informative science.

Throughout the motor industry, the camera serves shoulder-to-shoulder with the conventional implements of production experts, engineers and white-robed researchers.

In its myriad forms, some of which are strangers to even the most thoroughly-schooled "snapshot fans," the laboratory instruments of automotive photography have but a single scientific purpose: to search out the innermost secrets of materials and structures.

This information, recorded on sensitized plates or cellulose acetate films through special lenses, is essential to the making of better weapons for victory and the designing of improved vehicles for civilian use.

Among those who probe for knowledge with the camera, metallurgists make the most diversified applications of photographic processes. With their photomicrographs, for example, these automotive scientists are able to study the exact structure of any given metal specimen.

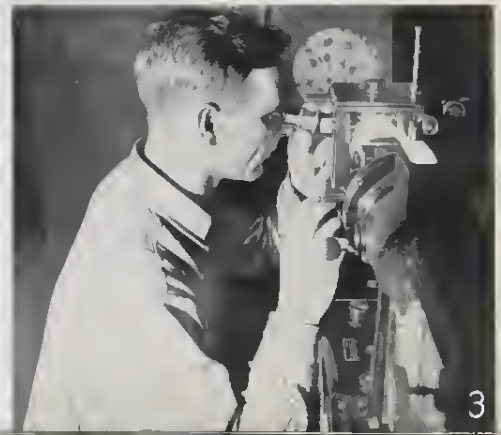

2

(1) Automotive technicians painstakingly set up a 1,000,000-volt X-ray machine preparatory to photographing a casting.

(2) A metallioscope is focused on an aircraft engine part. The resultant picture, recording a 1000-times magnification, permits research workers to study the part's micro-structure.

(3) Photomicrographs produce pictures at as much as 5,000 diameters, revealing such flaws in metals as minute porosity which would make a part unsuited for highly stressed engine operation.

(4) The concentration of atoms in a particular piece of metal is determined by Diffraction X-ray. Surfaces as thin as one millionth of an inch are analyzed by this camera. In operation the unit fires a stream of electrons against the surface to be analyzed, while the Diffraction camera photographs the angles at which the electrons are deflected. The deflection angle determines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For research technicians and production engineers, X-ray machines, with ranges from 50,000 to 1,000,000 volts, have proved to be a valuable ally. Such defects in aluminum and magnesium castings and similar metals as sub-surface cracks, internal flaws, non-metallic inclusions and shrinkage—easily overlooked by other test methods—are quickly turned up on X-ray plates by experienced workers.

One of the newer photographic tools of science to be found in automotive laboratories is the Diffraction X-ray. Using from 30,000 to 50,000 volts, approximately the same power as a physician's X-ray or fluoroscope equipment, Diffraction X-ray searches for the type and compound of elements present in a given metal sample. Another use of this camera is to measure surface and internal stresses.

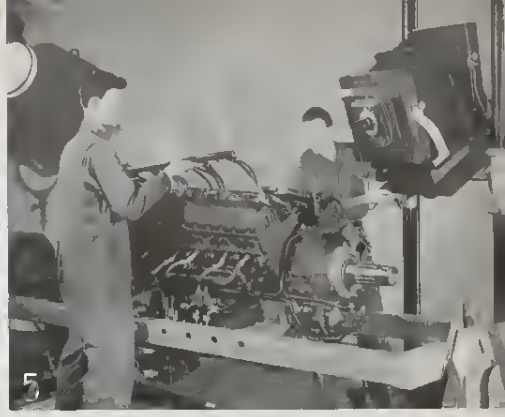
Even the ordinary 8 x 10 plate type camera has a place in the scientific work of automotive plants. In developing new products or refining existing models, components are subjected to strains until they break down, and then each piece is recorded on film or plate. From a series of such pictures, engineers have at their fingertips information which would take volumes to convey in words.

chemical structure of the material under test, and important facts about hardness and brittleness are revealed to the scientist.

(5) Pertinent data about engines, needed by the Army and Navy, and for the preparation of military technical training manuals, are recorded by this camera. Either 8x10 or 11x14 plates or cut film may be used.

(6) Taking 9,000 pictures a second—the usual home movie camera takes 16 a second—this high speed machine enables technicians to study motion of engine parts under extreme stresses. For example, the test shown here proves that the opposite ends of an imperfect crankshaft moving at 3,000 r p m may at a given instant be turning minutely in opposite directions.

(7) Metal composition of a product may be quickly determined in the spectrographic laboratory. Each metal present in a sample gives off a different colored light when burned in an electric arc or flame, and these patterns are as identifiable as fingerprints.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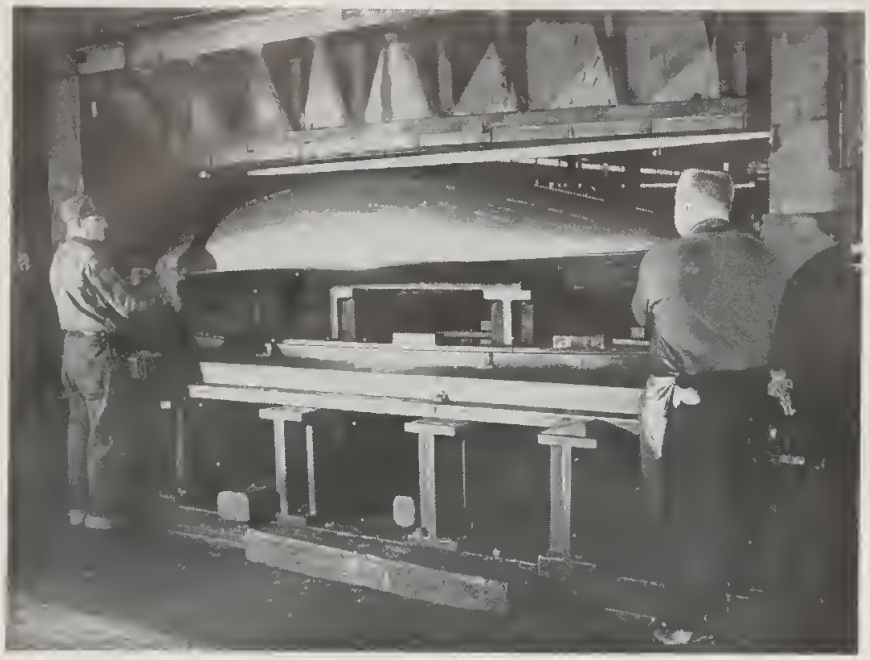

Gondola-shaped half of jettisan gas tank is lifted fram bed of giant press.

Revolutionary Technique for Shaping Aluminum Behind Motor Plants Huge Aircraft Production

"SHAPING aluminum alloys with hard steel dies just can't be done on a mass production basis!"

Comments such as this one were often heard by engineers of an automotive company earlier in the war when they proposed to meet huge aircraft schedules with the help of this revolutionary technique. At the time, such work was done by soft metal punches which could not be depended upon to maintain high precision work.

Today, in one automotive plant, scores of the new hard steel dies are being utilized to form the droppable gasoline tanks which make it possible for such fighter planes as the P-61, P-38 and P-47 to get the extra fuel necessary to accompany bombers on long missions. Some 17,000 of these jettison tanks, which weigh 160 pounds and carry over a ton of gasoline, have been turned out to date.

Up until its contract was cancelled a few weeks ago, another plant was using more than 16,000 hard steel dies to stamp out myriad parts for the B-24. Production engineers believe the method was instrumental in helping them obtain an output of one heavy bomber every hour.

Faith in hard steel dies was founded on manufacturing experience going back nearly 40 years, during which time automobile mass production was painstakingly worked out and developed into a precise science. Calling on the techniques acquired in fabricating steel fenders and bodies for motor cars, the automotive engineers figured that by adapting dies similar to those used in peacetime production to the fabrication of aluminum alloy metals, larger sections of work could be handled.

This proved to be the case, and as a result the number of presses needed to meet the schedules set up were materially reduced. Fewer workers, in turn, were required to perform assembly operations, and millions of man-hours were saved.

Manufacture of the dies for the bomber program was equivalent to the work involved in tooling up for four peacetime car model changes simultaneously. The die which stamped out the bombardier's enclosure, for example, weighed 15 tons.

Between 6,000 and 7,000 bomber parts, such as wing bulkheads, spar webbings, beltframes, outer shells for doors, engine cowling flaps, vents and reinforcements had to be produced for each completed bomber by these dies.

The jettison gasoline tank manufactured by this method is the largest aluminum drop-off tank ever made. Composed of matching halves, the tank when bolted together looks like a delicate "tear-drop." It is over 14 feet long, 35 inches wide and each half has a depth of nearly 17 inches.

To a large extent existing automotive machinery was converted to the production of the gasoline tanks, although dies for shaping aluminum had to be especially made and installed in the nine press operations which make up the fabrication sequence.

The initial operation, wherein a sheet of aluminum is formed into an unfinished tank half, is performed on a press which once made passenger car body tops. The special die used in this machine weighs 60 tons.

Here Is What It Takes To Turn Out a Product

MAKING an automobile, a tank, a gun, a bomber or any of the 300 wartime products of the automotive industry is not unlike baking a cake in a big restaurant kitchen.

To bake a cake, a chef and his cooks must have on hand the necessities—raw ingredients implements for assembling components; and machinery for transforming raw material into a finished product. For all this, a recipe, or rule of procedure, must be followed. But most important in the art of cake-baking are the human beings involved.

In the automotive industry, too, people are the most important single element. Taken into plants and trained as skilled "bakers" of metal things, people, rather than the machines they use, fashion complicated products from raw ingredients.

Like cooks, they must follow a recipe. They must go to the right places in a plant—to machines, piles of raw material, trucks for moving goods from the piles to machines and for moving parts in process.

But even coming into the plants and going to the right places is not all of the mass production recipe. Factory workers, like cooks, need direction from management representatives, generally known as foremen. The latter have the manufacturing schedules, material routing sheets, blueprints and the knowledge of how people and machines must be arranged to turn out a product.

On the foreman's shoulders, therefore, falls the responsibility of imparting to those who run the machines the knowledge of what is to be done in order to carry out the plans. In short, the foreman's function, as a chef's, is to see that the recipe is followed.

New Schedules Reflect Importance of Trucks

(Continued from Page 1)

home docks until the walkout ended.

Throughout the strike retail establishments lacked many staple products ordinarily available despite wartime shortages. Grocers' shelves were bare of fruits and vegetables. Department store counters were empty of ordinary articles of apparel and common household furnishings. Drug stores ran out of prescription ingredients. In desperation, housewives journeyed from one store to another to find what they needed.

Food distribution was prevented to the extent that some 100 tons of perishables spoiled in the warehouses of one company alone. Even rotting produce could not be hauled to the city dump for disposal.

Railroad freight facilities were reported snarled as far as Kansas City and Buffalo. Thousands of such cars accumulated in Chicago's switching yards, causing a nationwide embargo to be placed on shipments to the area.

Scores of war plants in Illinois, Wisconsin and Indiana were forced to either shut down or curtail operations due to the lack of incoming and outgoing shipments of raw materials and finished components by truck.

So completely did the strike disrupt the civilian economy and the war effort that a military police battalion, equipped with 150 Army trucks, was assigned to the city.

When the second tie-up occurred, affecting approximately 35 per cent of the city's trucks, the Army assigned more than 1,200 drivers and 2,500 military police to the task of keeping materials flowing between plants so that the war effort would not again suffer.

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Pump mechanism of "The Brain" is tested for leakage and current consumption.

Instrument Made by Automotive Hardware Firm Guides Superfortresses to Japanese Targets

TO PILOTS of Navy bombers and fighter planes, and navigators of the Army's giant B-29 Superfortresses, targets and home bases in the Pacific are no more than pinpoints on a vast map.

Yet, in spite of long over-water flights made doubly hazardous by fog, storm and sudden darkness, they will hit their objectives on the nose and as unerringly return—all without benefit of sextants, radio beams or other ordinary navigational aids.

The device that makes such feats possible is known as the Air Position Indicator, and its three major components are being turned out on a quantity production basis by an automotive company, a firm which in prewar years was a major supplier of automobile hardware. Composed of hundreds of precision-made parts, these three subassemblies are the computer, pump and right-hand drive.

Manufacture of the delicate aircraft instruments calls for extremely close tolerances, utmost cleanliness throughout each operation, and the fulfillment of rigid government and management tests. As an example of the care which goes into the production of the Air Position Indicator, parts for each component are put together on progressive assembly lines in air-filtered rooms by women wearing special lint-free clothing.

Additional production information about the Air Position Indicator is at present a closely-guarded military secret; for its contributions to the air warfare against Japan are being heavily counted upon to help speed V-J Day.

Called "The Brain," the unit is about the size of an ordinary milk bottle, and is hooked to a plane's compass and speed indicator by the computer.

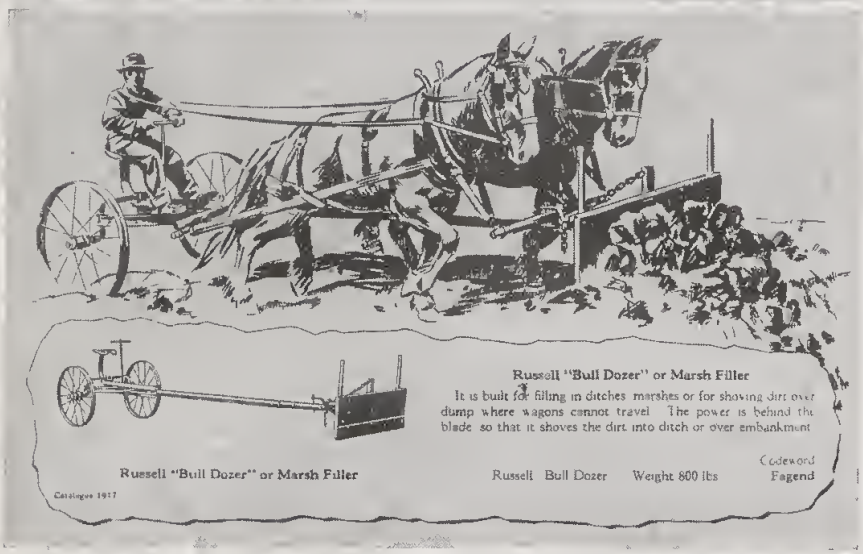
When a big bomber takes off from the Marianas to blast Japan, or a fighter plane leaves a carrier's flight deck, the pilot or navigator simply records latitude and longitude on the instrument. At this point the mechanical "Brain" takes over. From the data about direction and speed automatically received during flight, the instrument's computer calculates the aircraft's ever-changing latitude and longitude, but does not allow for wind-drift.

To find out his plane's exact geographical position on the chart before him, the navigator or pilot reads the indicator's dial, just as a motorist reads his car's speedometer. Corrections for wind-drift are then made by a small instrument known as a drift meter.

PICTURE CREDITS: Page 1—Acme Newspictures, Inc.; Page 8, lower right—U. S. Navy.

THE BULLDOZER — PART III

Ancestry of War's Surprise Weapon Traced To Primitive Planting Stick and Treadmill



ALTHOUGH millions of people think of the bulldozer as the secret and surprise weapon of World War II, its newness is only in its application to military uses. Tractors equipped with bulldozer blades have been utilized by earthmovers since the early 1920's. Prior to that, horses provided the power.

The earliest bulldozer of record was offered in a catalog issued in 1917 by the Russell Grader Manufacturing Company of Minneapolis, Minnesota. As accurately as can be traced, the name seems to have come from a heavy horizontal press which has been commonly used in forge shops for many decades.

Strictly speaking, the bulldozer is the blade and the mechanical and hydraulic contrivances with which it is suspended from the vehicle and controlled by the driver. The history of that blade begins with the crude planting stick of primitive mankind.

To its evolution most of the important contributions have been the fruits of American inventiveness.

Such contributions include the bull-tongued plow with which early colonial settlers broke the soil of the wilderness, the iron plow which Charles Newbold invented, the scientifically-curved moldboard that Thomas Jefferson devised for turning the earth and cutting a clean furrow, the assembled plowshares that Jethro Wood perfected, the tempered steel blade introduced by John Lane in 1833, the light-weight all-steel plow, the crude horse-drawn scraper that appeared 75 years ago, and the wooden Mormon-board plow that graded the roadbeds for the first of the nation's continent-spanning railroads.

Naturally, the application of combustion engines as power sources for overland transportation suggested to many minds their potential use as power sources for pulling plows.

The trouble with steam engines, however, was their weight. This factor, which diverted the locomotive off the road onto its own specially-created highway, baffled all experimenters with steam-powered plows until the Englishman, John Fowler, devised a steam engine light enough to use English roads, and perfected a winch whereby such engines, standing on opposite sides of a field could draw a plow back and forth by means of steel cables.

When he tried to sell his invention to Americans, he learned our fields were too big and our roads too primitive for such heavy, remote-control apparatus.

This condition prevailed in the United States until the advent of the automobile. With the appearance of that lighter, internal-combustion-engine-powered vehicle, a vast amount of experimenting began in methods for its operation over terrain not adapted to its traction principle.

The engineering principle known as "all-wheel-drive," developed in 1906 by Otto Zachow, a Wisconsin blacksmith, and almost universally employed in all wheeled and engine-powered vehicles used in World War II, was the result of one of these early experiments.

Other experiments finally evolved into the crawler-traction unit of modern tanks and bulldozers. But the principles embodied in such devices are as old as the idea of the treadmill. In 1851, Clement Messerano of Turin filed a patent application for a locomotive with which he proposed to translate the pulling power of a horse —mounted on a treadmill—into tractive force applied to the road surface.

Another early attempt to keep vehicle wheels out of the mud showed up as a steam-engined supply train in the Crimean War in 1854. Called the Boydell Traction Engine, this British innovation had its driving wheels equipped with huge pendant "shoes," called "porterails," which flopped to the ground as the wheels turned and thus provided a movable highway.

The solution came eventually from the American farmer and from the farm implement and automobile industries to which he looked for help in his struggle to lighten his burden and increase the productivity of his vocation.

Out of the middle west around the turn of the century came scores of patent applications for crawler-traction devices. By processes of refinement, the best of these ideas worked their way onto automotive vehicles. Then, as the American people took this combination of European inventions called the "automobile" to themselves and made of them mass-produced conveyances for mass-transportation, the four-wheeled tractor plow also emerged.

(Concluded next month)

Modern bulldozers carved Pacific roads.

AUTOMOTIVE WAR PRODUCTION

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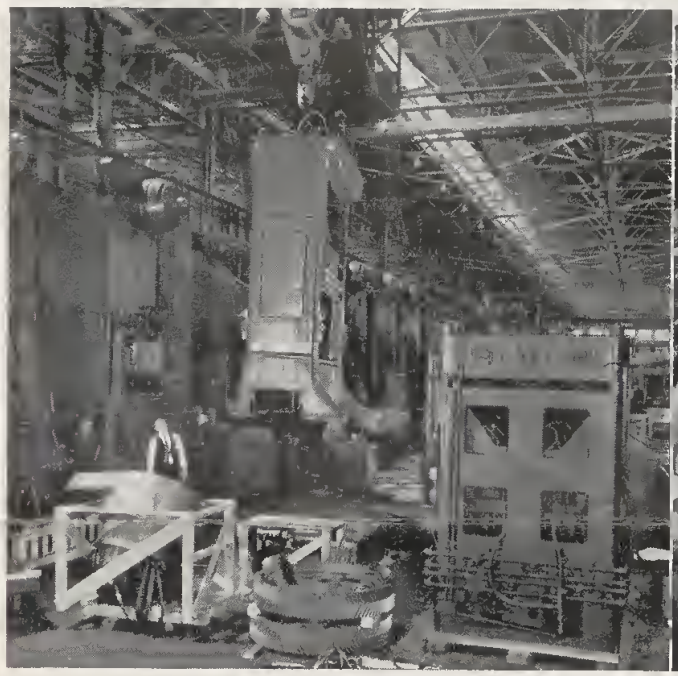
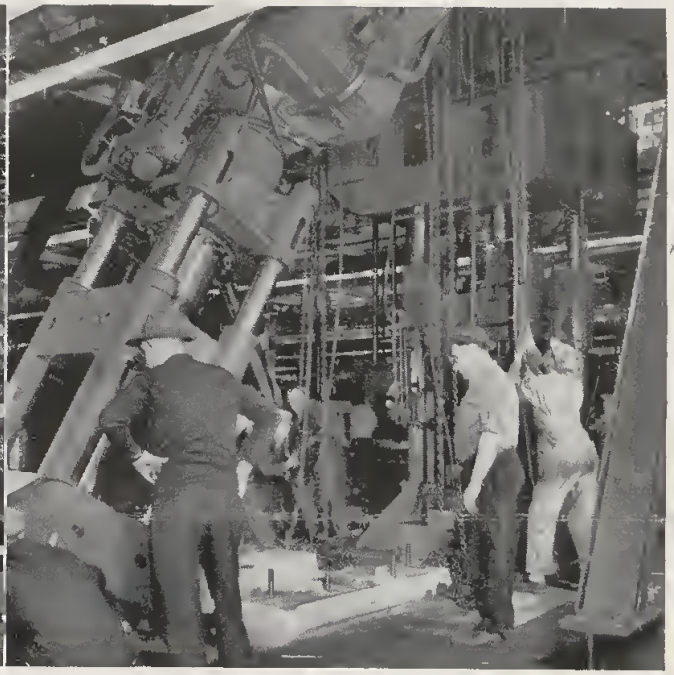




Industry Faces Complex Tasks During Reconversion

Plants Display Ingenuity in Providing Space For Production of Both Arms and Automobiles

WITH the crescendo of aerial and naval blows against the Japanese homeland mounting to new peaks, redeployment of millions of troops and thousands of shiploads of tanks, trucks, aircraft, guns and other weapons needed for invasion is swinging into high tempo.

On the home front, too, a huge government-authorized "redeployment" movement is under way in thousands of American industrial concerns whose only job until recently has been the production of military supplies. This internal re-alignment of domestic war industries, made possible by the smaller munitions requirements of a one-front war, will safeguard the jobs of thousands of war workers as well as the employment opportunities after the war for millions of men in the armed forces.

Typical of what is happening in industries all over the country, but of a magnitude unrivalled elsewhere, is the reconversion of manufacturing facilities now taking place in automotive plants. In them, even though fulfillment of continuing war contracts remains the Number One job, sufficient space and machinery has been freed by contract cancellations and cutbacks since V-E Day to make possible the resumption of some automobile production for the dual purpose of providing jobs for idle war workers and manufacturing vehicles to replace those which have been worn out and scrapped during the war years.

A variety of problems face automotive manufacturers. One company, for example, is experiencing an even greater demand for war equipment since the all-out offensive against Japan became the military's paramount objective. Another company, whose particular war jobs were strictly for the European front, received early contract termination and therefore has ample space and equipment available for production of needed civilian passenger cars and trucks. Still others find themselves called upon to step up the output of some military items for the war with Japan, yet have sufficient war contracts cancelled to permit partial reconversion. Their toughest job is to consolidate continuing war work in their plants, so space may be made available for setting up the machinery necessary for mass production of automobiles.

Numerous examples of ingenuity being exercised in redeploying military and civilian production facilities are

(*Continued* on *page* 7)

STEEL—BASIC INDUSTRIAL INGREDIENT

Motor Industry Was Largest Domestic Buyer Of Steel Products in Years Before the War

Digging iron ore from open-pit mines coils for o wide voriety of outomotive vehicles.

REDUCED to its fundamentals, the automotive progressive assembly system is primarily a method for turning out *finished* goods in large quantities. Wartime experience proved that this method is as applicable to the manufacture of tanks, airplanes and guns as to the making of passenger cars, trucks and buses for civilian use.

Often overlooked, even though it is basic to full understanding of the automotive manufacturing technique, is the fact that motor vehicle makers are the final link in a nationwide industrial chain which starts on the farms and in the mines and ends in the shiny new automobile or truck driven from the assembly line of some great factory.

Because 80 per cent of the total weight of a modern passenger car or commercial vehicle represents the various kinds of steel used in its component parts, this metal is the material out of which most links in the automotive mass production chain are forged.

To produce 3,692,328 automobiles and 777,026 trucks in 1940, motor vehicle manufacturers consumed 7,195,339 tons of steel.

Excluding such products as farm implements, diesel engines, radios, refrigerators and a long list of other consumer goods made by many automotive companies before Pearl Harbor, this huge consumption amounted to nearly 18 per cent of the steel industry's annual capacity. It placed the motor car industry in the position of being the nation's largest single consumer of steel products before the war.

The metal requirements of a modern passenger car or truck call for 125 different kinds of steel. Sheet steel, for example, is used for bodies and tops; strip steel is formed into window moulding trim, brackets and wheel rims; alloy forging bars are turned into axle shafts, connecting rods and gear blanks; spring steel in flat form is made into leaf springs, and heavy steel wire into coil springs.

Production of high-quality steel for such uses in the motor industry reflects a close knit partnership between automotive and steel industry technicians. Each of the scores of different types of steel are manufactured and tested according to product standards set up by automotive engineers. These specifications make it possible for the delicate, precision tools of lathes and presses to do their particular jobs without danger of damage because the steel in process is too hard or too soft.

During the war years the capacity of the steel industry to produce has increased approximately 30 per cent, production in 1944 reaching an all-time high of 89,576,000 tons compared with the previous peacetime record year of 66,982,000 tons in 1940.

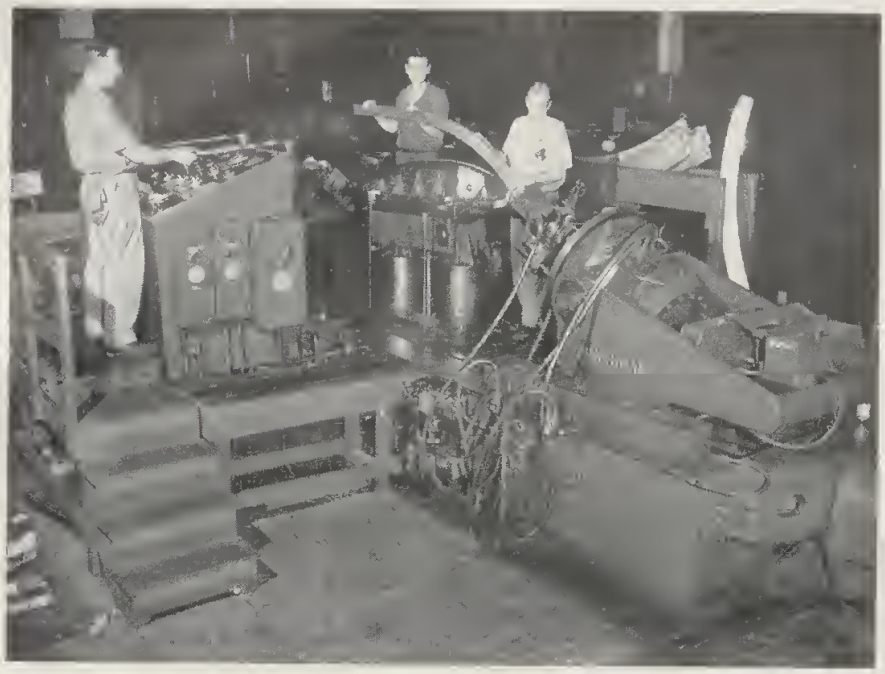
Now, with war demands dropping off as industry switches to a one-front war job, steel mills are looking to the future. They are studying their production schedules closely so they may make the many types of steels needed for new car production, refrigerators, washing machines and similar civilian consumer goods. Steel for tomorrow's home-front necessities already is being tempered in giant crucibles today, many months ahead of its actual use.

Ore is chonged into pig iron in these blost furnoces.

Open heorth furnoces convert molten iron to steel.

Steel pourer wotches streom of metol filling ingot molds.

To obtoin o uniform temperoture ingot is sooked with heot.



More than 40 aluminum aircraft parts are stretched and formed by this machine.

Development of Machinery to "Stretch" Metal Improves Aircraft Work of Automotive Plants

THE OLD-FASHIONED taffy pull, that universally popular institution of American kitchens and small town church socials, now has a fascinating counterpart in the automotive industry.

Through the development of ingenious machines, which have eliminated hundreds of hours of hand-toil and reduced manufacturing costs by thousands of dollars, literally millions of feet of aluminum materials have been stretched, shaped and formed by automotive plants into structural parts for use in such bombers as the B-29 Superfortress, the B-25 Mitchell and the B-24 Liberator.

Watching one of these automotive-industry-designed stretching machines in operation, you see a 28-foot rib-like aluminum stringer actually grow more than a foot in length. If such a machine should be operated for nine successive hours, some 20,000 linear feet of this material could be processed.

The stretching of aluminum pieces in the production of aircraft components and subassemblies is a process necessary to the straightening, strain-hardening, strengthening and forming of parts that cannot be shaped efficiently in any other way.

Before the war aluminum stock was stretched by a hand-hammering method or, in some instances, by a cumbersome steam-operated machine. This was done primarily as a means of straightening the metal. Ordinary dies in large presses were then used for the final forming operations. Strain hardening was an incidental result of the process.

Engineers at one automotive company found that the physical properties of aluminum were such that many bomber parts could not be efficiently formed by such dies if aircraft output was to be on a truly mass production basis. "Spring-back" of the material under the old method posed additional problems, indicating that it would have to be drawn or form-shaped under pressure to achieve the desired shape.

In order to provide for adequately forming parts on the automotive production basis, the company's tool design engineers combined the hardening and forming operations into a single process called stretch-forming, using a stretcher die (similar to a press die) in a hydraulic machine.

According to the company's engineers, the explanation of the remarkable strengthening effects achieved in this stretching process seems to be that each circular molecular body in the aluminum is drawn out into an egg-shaped elliptical particle, making the metal extremely hard and strong. The improved parts thus produced are much easier to handle than those made under the old process. Further, stretcher dies cost only 50 to 60 per cent as much to build.

Another company, which built its stretching machines from discarded equipment once used in the manufacture of automobile bodies, reports that to date the process has resulted in a saving of approximately $200,000 over what it would have cost to turn out aircraft parts by the lengthy, tedious hand-hammering operation.

Before the stretching machines were developed and put into use by this company, a worker was able to finish-form only a few parts during an eight-hour day. Under the new production set-up, the same worker can complete more than 200 parts daily.

The stretching machines employed by the motor company consist of a specially-built, table-height base upon which are mounted two hydraulic jaws and a form whose contour matches the finished part. The jaws pull the part against the form with a pressure ranging from 500 to 1,300 pounds, forcing the metal to relax into the desired contour.

War Production Briefs . . .

A contract for the manufacture of 12-man squad tents has been awarded to a producer of passenger cars and commercial vehicles. The tents, measuring 16 x 32 feet each, are to be supplied at the rate of 2,000 a month.

* * *

Since the start of its war production program, one automotive company has built more than 125,000 cannon of various sizes and more than 40 billion rounds of ammunition, ranging from 75 mm. to 155 mm. calibres.

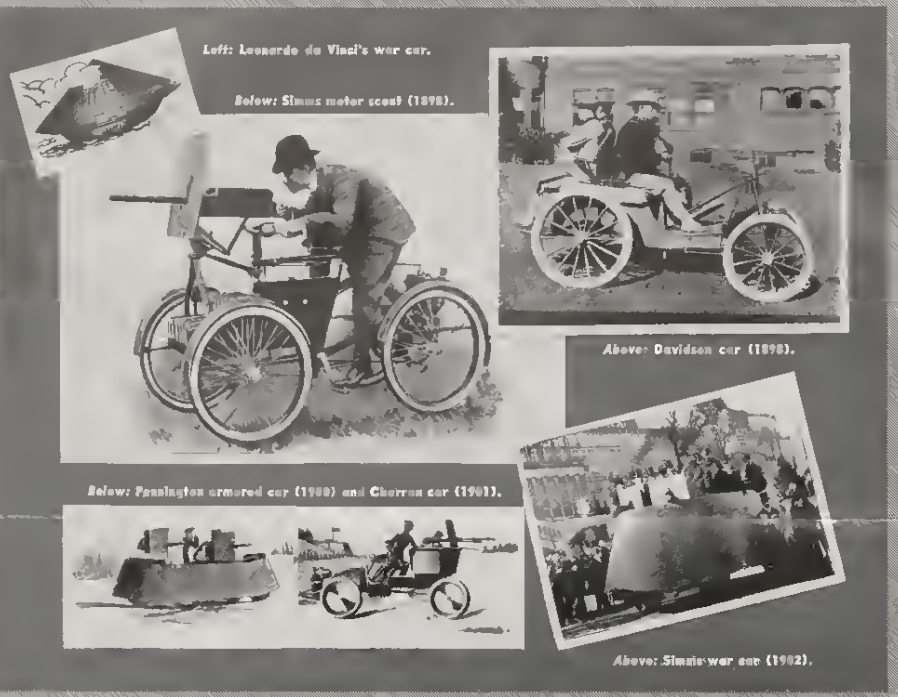
* * *

In the four years since it undertook to produce in quantity an aircraft engine of foreign design, a former motor car manufacturing company has improved the product so that operational life of the engine in combat has reached 510 hours instead of the normal standard of 200 hours.

* * *

During the 1,249 days between Pearl Harbor and V-E Day, a motor company and its subcontractors produced more than 40 million units of precision automotive, aircraft and ordnance equipment. This was turned out at an average rate of 32,000 units daily.

WAR ON WHEELS



Left: Leonardo da Vinci's war car.

Below: Simms motor scout (1898).

Above: Davidson car (1898).

Below: Pennington armored car (1900) and Charron car (1901).

Above: Simms war car (1902).

MOTOR-DRIVEN vehicles of war have brought army mobility to a point undreamed of at the turn of the century, far surpassing the achievements of World War I.

Today's accomplishments, however, reflect far more than the world's mechanical progress during recent decades. In fact, they climax a 4,000-year effort toward attainment of mobility in warfare, of which the first example on record is a war chariot developed in 2059 B.C. by an Assyrian king.

By the twelfth century B.C. the Chinese were using four-wheeled "war" carts with sides of heavy leather serving as armor plate. This progenitor of the 1945 tank was followed in 1482 by an armored war car equipped with firearms and designed by Leonardo da Vinci, who recommended that chariots spearhead the advances, allowing the infantry to follow "in safety and without opposition."

With the development of the internal combustion engine, military minds of many nations began to ponder the possibilities of its use. One Lt.-Col. Otfried Layriz, of the Imperial German Army, published a book in 1900 in which he contended that Prussian victories over the French in 1870 were largely due to timely and ingenious use of the railway and telegraph, and boldly predicted that within the near future road locomotives or automobiles would become important instruments of warfare.

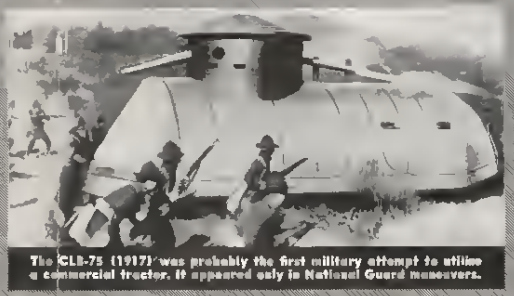
His predictions were fulfilled in 1914 when the famed French taxicab army stopped the Kaiser's legions at the Marne River. So far had motorized warfare progressed by 1916 that General Pershing was able to cross into Mexico with 74 motor truck trains. In France, the siege-bound garrison at Verdun was sustained and supplied by 6,000 trucks.

The Simms "Motor Scout," built in England in 1898, is reputed to be the first automobile in the world designed specifically for military combat purposes. Shortly afterward a steam-powered car, mounting an automatic gun, was developed by Major R. P. Davidson. Two of these cars, probably the first four-wheeled military vehicles to be designed in the United States, were constructed by a pioneer automobile manufacturer in Illinois.

With the exception of the photograph of the anti-aircraft truck, the illustrations are from the Colonel Robert J. Icks Collection. They are reproduced here by courtesy of the collector, The Philip Andrews Publishing Co., and Duell, Sloan and Pearce, Inc. Both the pictures and some of the historical information are drawn from the new book, *"Tanks and Armored Vehicles"*

Built in 1900 in the manual training shops of a military academy, this Davidson steam car mounted an automatic gun.

This two-man tank, weighing three tons, could travel only 34 miles before refueling. It was built in 1918 by a U.S. automotive company.

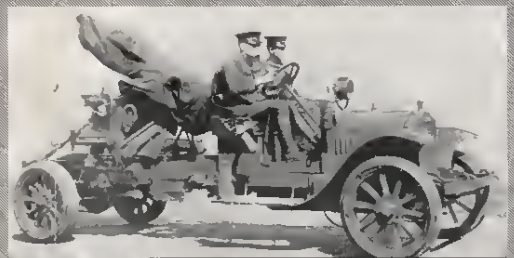


The CLB-75 (1917) was probably the first military attempt to utilize a commercial tractor. It appeared only in National Guard maneuvers.

To make this 1915 armored car, designers placed a .2" thick steel hull surmounted by two turrets on a standard 4 x 4 truck chassis.

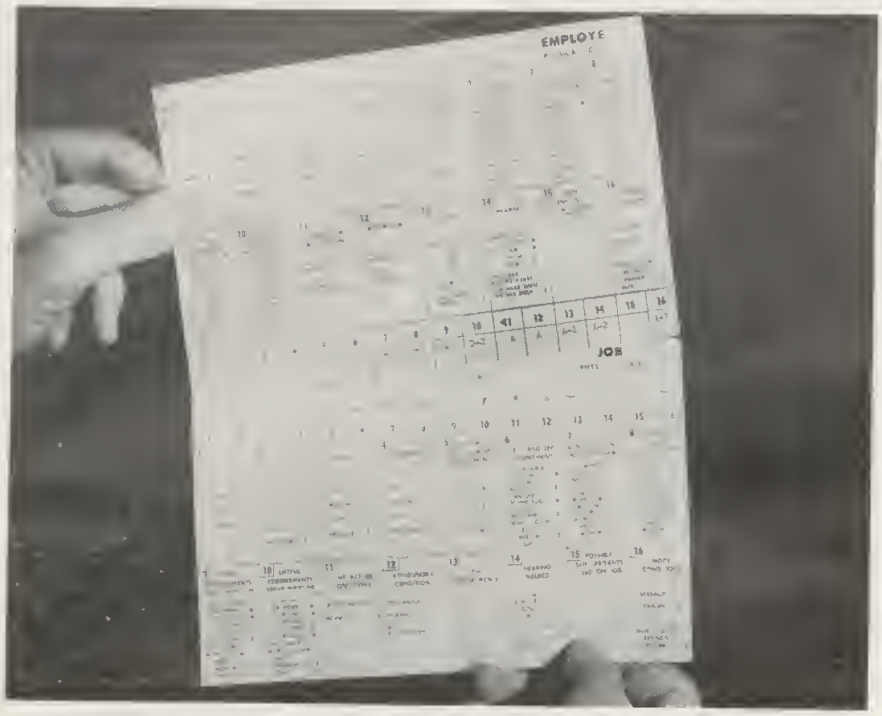
Developed by the British, the Mark I tank appeared on battlefields in 1916. The vehicle weighed 30 tons and had a range of 12 miles.

The more heavily armored British Mark III, also brought out in 1916, carried machine guns and a six pounder cannon.



This standard military truck, armed with anti-aircraft cannon, was one of the first vehicles used against planes by Army ground forces.

Built for the Army in 1931, the 11-ton T-3 tank ran on either wheels or tracks. The changeover could be made in less than 30 minutes.



Job and physical standards rating cards have been developed by one company.

Motor Plants "Measure" Jobs and Veterans In Effort to Avoid Square Pegs in Round Holes

VETERANS returning from the world's battlefronts to resume civilian occupations in the automotive industry are finding that something new has been added to the employment procedures they knew before the war.

Now, in an effort to fit the man and his work, automotive companies are "measuring" the returned soldier or sailor for a job—just as carefully as a tailor would measure for a suit of clothes. Likewise, the standards and requirements of a job are "tailored" to fit the veteran.

Details of veterans' programs carried on by various companies differ, but all have the same objective: to provide the returned service man with an opportunity to stand on his own and take his place in the civilian world.

At one automotive company each job in the plant has been rated on the basis of answers obtained to 16 questions, and the findings were recorded and filed on a permanent rating card.

First question asked in the survey was: Does the job require a man or a woman? The next information needed concerned age as well as height and weight requirements. Other queries dealt with standing and walking requirements, feet and leg requirements, use of arms and hands both normally and overhead, lifting requirements both above and below the waistline, sight and hearing needs, and conditions of temperature, atmosphere and noise.

A veteran applying for work undergoes a thorough physical examination. Its results, together with his stated job preferences, are noted on a permanent file card. By studying the two cards, the company's employment specialists are able to determine at a glance the particular spot in the plant that the veteran is best suited to fill. This is extremely valuable in assisting veterans having a disability. Others with no physical handicaps and with the necessary seniority return to their former jobs.

Another motor company sponsors schools where veterans who have been found physically capable of performing certain jobs may receive special training. For instance, when one ex-soldier, who had suffered a serious gun wound in battle, was unable to do active factory work, he was trained for time study duties.

For those veterans who prefer work in automobile repair shops or dealers' establishments, a third manufacturer has developed an "on-the-job" training program. Conducted in cooperation with the Veterans' Administration and other federal, state, county and city agencies, the company's entire sales and servicing organization in 7,500 retail outlets across the nation are enrolled in the operation.

In a move to aid returned veterans in obtaining employment and training in automotive maintenance, the Automotive Council for War Production last month made 60,000 pamphlets available to motor vehicle and parts companies. The pamphlets, distributed to retail outlets and service branches, detail for employers the latest automotive industry and government plans for jobs and training.

Motor Plant Converts For Eighth Time in War

ONE OF the automotive industry's most versatile war plants is reconverting its machines and facilities for the eighth time since Pearl Harbor.

Unlike many other automotive plants, however, this one isn't reconverting to make automobiles again. Instead, it has taken on a new war job—the manufacture of 7,500,000 incendiary bombs for use in B-29 Superfortresses.

Designed originally as a factory where components and subassemblies would flow in at one end and emerge at the other as finished passenger cars, this factory during the past three and one-half years has made weapons as diverse as small arms ammunition and military vehicles.

Since early 1942, over 3,000,000,000 (billion) cartridges of .30 and .45 calibre have been produced, including the first steel-case calibre .45 cartridge accepted by the Army for combat use. The next job called for development and manufacture of hermetically sealed metal containers in which such ammunition could be safely packaged for overseas shipment.

The plant has also reconditioned 1,800 used General Sherman tanks, installing new motors and adding extra-heavy armor plate; it has rebuilt thousands of Army trucks for combat; and several hundred thousand tank tread cleats have been turned out.

To prepare for the new assignment, automotive layout engineers are remodeling and expanding several structures in a restricted area, adjoining the main building, where powder was loaded into the small arms cartridges.

Automotive Industry Redeploys Facilities

(*Continued from page 1*)

to be found in motor plants. For instance, one company moved 229 machines, which were being used to turn out tank axles, to another plant a quarter mile away without loss of production. Into the space made available in the old structure was moved automotive equipment.

Another automotive company is currently spending more than $1,500,000 to concentrate all of its war production activities in a single building. The project involves complete duplication for car making purposes of much of the equipment now used to build such tracked military vehicles as the Weasel.

The greatest physical problem encountered by a third company during its reconversion is the moving and re-installation of more than 20,000 machines. This equipment ranges in size from small drill presses and lathes to giant hydraulic presses weighing as much as 150 tons each.

A grand total of more than 3,000,000 tons of machinery, dies and similar productive equipment will be handled in this plant during the reconversion period, the superintendent estimates. When the work is finally completed, approximately 2,700 automotive machines will be installed in this one building, and some 2,000 war machines will have been moved out.

To house its civilian production activities, a fourth company is now in the process of tearing down two 40-year-old structures and replacing them with modern plants. Completion of the construction job is scheduled for October 1, but automotive manufacturing operations will be under way as soon as the floors are in and the roofs on.

AUTOMOTIVE WAR PRODUCTION

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Automotive Council for War Production
GEORGE H. CUSHING, Editor
New Center Building, Detroit 2, Michigan

Worker prepares to turn out aircraft parts on ordinary "job shop" printing press.

Engineers Devise Novel Printing Press Use to Help Meet Huge Navy Aircraft Schedules

TO MOST people a printing press is a machine which makes possible books, newspapers, magazines, pamphlets and a host of other items for reading, but to automotive engineers it also is a machine important to the production of motor cars or war weapons.

Latest and most novel use of a printing press in the automotive industry is to be found in one of the plants of a company now engaged in building Navy aircraft. Here an ordinary "job shop" type press stamps out small die-cut aluminum parts for carrier-borne torpedo bombers.

The wartime application of such a machine grew out of the prewar practices of several automotive parts suppliers who had used printing presses to stamp out cardboard filler panels, those parts of a motor car's body to which upholstery is attached.

Searching for a faster, cheaper and more accurate way of making the small aircraft components than was possible with either the accepted metal dies or router methods, the company's engineers turned to this tried and proved motor industry technique. Not only was manufacturing time and overhead saved but a major production step was eliminated, in turn reducing machine tool requirements for the job.

Here is how the method works. Dies for one jaw of the press are made of plywood, with a strip of steel rule inserted to shape and cut the aluminum. Into the other jaw a pad of rubber and cork composition is inserted as a stripping agent against the material when the press closes under pressure.

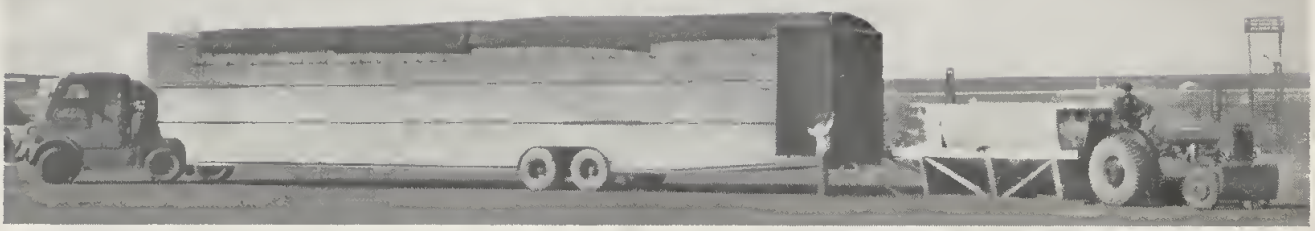
After the press had been tested in operation, engineers found that twice as many parts could be made each hour as could be turned out by using metal dies, and eight to ten times as many as by the router method. Furthermore, tooling costs were only three per cent of the metal dies process and only 10 per cent of the amount expended to make a router template.

With design changes in its aircraft constantly being recommended by the Navy, the printing press method has also proved to be far more flexible. For instance, rule dies are made in less than two hours and may be repaired in 30 minutes. In contrast 48 to 60 hours are required to repair metal dies, while an average of 15 hours is needed to make a router template.

Formerly, parts made by the router method required a deburring operation before they could be used. Often as much time was needed to deburr as to turn out the part. The printing press, using rule dies, eliminates this time-consuming production operation.

Wheeled Victory

Cross-Country Truck-Trailer Network Keeps Aircraft Plants Supplied With Vital Parts



MORNING . . . noon . . . and night — threading their way along twisting highways in snow-capped mountains; moving swiftly over the straight, ribbon-like roads of the middle west's flat plains country; or roaring through the lush, green farmlands region of the Atlantic seaboard—motor trucks are on the move.

Operating on a 24-hour-a-day basis, regardless of weather conditions, commercial vehicles of all types and sizes are performing services essential to the building of weapons for victory over Japan because of their ability to pick up and deliver war materials at the exact point of need.

For example, an aircraft company which makes dive bombers and cargo planes for the Air Forces has solved its materials movement problems by employing eight huge fleets of trucks and truck-trailers as its conveyor system. Specially designed for hauling anything from small components to giant fuselage sections, these vehicles link final assembly lines with fabricating and manufacturing plants in 16 cities located in 10 states.

Distances traveled by the truck fleets reach astronomical figures. The vehicles operating in and out of the firm's main assembly plant at Buffalo cover over 1,000,000 miles a month.

At a second major assembly plant in Columbus, Ohio, the company's trucks rolled up a total of 566,984 miles last year transporting the center panel for the dive bomber alone. Three other fleets averaged 165,000 miles each month in 1944 over three different routes totaling 1,575 miles. These vehicles fed an assembly plant in St. Louis, Missouri, with components made in Detroit, Michigan. Completed major assemblies were then hauled to either the company's Buffalo plant or a final assembly factory in Louisville, Kentucky.

Another truck fleet, composed of "delivery Dachshunds," long, lean tractor-trailers with a capacity of almost two and a half railroad box cars, makes daily runs between Kenmore, New York, and St. Cloud, Minnesota, hauling fuselage sections.

These 10-wheel giants are owned by the United States Army, and their drivers are sworn in as members of the Auxiliary Military Police. An entire truck-trailer combination is 64 feet 9 inches long, 8 feet 9 inches wide and 12 feet 8 inches high. By comparison, the average railroad box car measures 40 feet 6 inches long, 8 feet 6 inches wide and 8 feet 7 inches high.

The outer wing panel is one of the largest components going into the company's cargo plane. Despite their size, these subassemblies are transported in truck trailers from fabricating plants in New Orleans, St. Louis and Akron to the Buffalo final assembly line. Each trailer is capable of carrying one set of panels. The trip from New Orleans to Buffalo, a distance of 1,500 miles, is made in six days as compared to 21 days' minimum travel on railroads.

Horses Speed Traffic At Automotive Plant

BELIEVE it or not, but an automotive company has "taken its hat off to the horse."

Although motor cars daily transport most of the firm's 67,000 workers to and from their jobs, mounted police are on duty at each of the plant's entrance and exit gates to prevent crippling traffic jams. Company officials report that by this method of traffic control, the time needed to change a work shift has been slashed by as much as 30 minutes.

In appreciation of the work performed by the police detail, the automotive company recently built and donated to the officers and horses a super-deluxe barn located at a central point on the firm's property.

The building is the last word in horse barns, and every effort was made to please both animals and riders. Here are just a few of its unusual features. The name of the horse is affixed above each stall, a special mill prepares feed before it is given to the animals, and there are fully-equipped saddle and blacksmith shops for necessary repairs.

AUTOMOTIVE
WAR PRODUCTION

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Industry's War Job Ends With High Output Totals

"War is no longer Samson with his shield and spear and sword, and David with his sling; . . . it is the conflict of smokestacks . . . the combat of the driving wheel and the engine."
—Newton D. Baker, Sec'y of War, 1916-21

SINCE the beginning of World War II, the "smokestacks" of the automotive industry have been a barometer which recorded an ever rising flood of driving wheels, engines and hundreds of other types of combat weapons pouring from motor industry plants. At the time of the victory over Japan, the industry had delivered a grand total of $28,970,000,000 worth of military materials to the fighting forces of America and its allies.

With the lifting of censorship restrictions, the automotive industry is permitted to report publicly these facts about unit deliveries.

From the beginning of World War II to date, motor car plants produced 5,830,980 guns, ranging from sub-machine guns to anti-aircraft cannon. Engines for aircraft, tank, military truck and marine use totaled 4,000,000 units. More than 191,000 tanks, armored cars and self-propelled artillery rolled from automotive assembly lines. Other military vehicle production, including trucks, jeeps and trailers, passed the 3,100,000 mark.

In addition, automotive manufacturers turned out 21,835 airplanes, 4,288 gliders, 2,000 aerial torpedoes, 2,000 buzz bombs, 7,800 marine tugs and tractors, 62,000 field stoves, 5,500 gyro compasses for the Navy and 30,000 fire pumpers to combat incendiary bomb raids.

Output of aircraft, parts and subassemblies by former automotive producers ranked highest on the industry's production slate, accounting for $11,244,857,000, or 38.8 per cent of the total dollar volume. Deliveries of mobile units totaled $8,591,143,000 for military vehicles and $3,781,356,000 for tanks. Production of marine equipment amounted to $1,951,658,000.

Of the remaining products delivered to the fighting forces of the United Nations, guns totaled $1,589,841,000; ammunition, $907,535,000; and miscellaneous equipment, consisting of over 300 items, $903,610,000.

Trucks on Chino's Burmo rood wind along the tortuous Solween River gorge.

Mountains of Military and Civilian Supplies Carried by Nation's Truck Fleet During War

GENERAL George S. Patton recently paid tribute to the motor truck as the "Army's most valuable weapon."

His praise echoed what fighting men in every war theatre have proclaimed in regard to the jobs that trucks have performed throughout the battles of World War II. And it pointed up the manner in which commercial vehicles on the home front proved to be the unbreakable transportation link between raw material sources, manufacturers, the armed forces and civilians. Their ability to move goods swiftly under the most difficult conditions with a minimum of expense and handling was a valuable transportation asset.

The extent of military motorization in this war is graphically illustrated by a single order for 880,000 vehicles placed one day in 1943 with automotive companies by the Army Ordnance Department. When Victory came last month, automotive and truck manufacturers had produced for military use approximately 2,600,000 cargo and personnel-carrying vehicles, including those shipped to Allied nations under Lend-Lease.

To meet the demands of global warfare the motor industry manufactured a wide variety of all-purpose trucks, each type built to withstand the varied peculiarities of specific combat areas. In Alaska and Russia it was sub-zero temperatures; in the Southwest Pacific, North Africa, China and India it was tropical heat, torrential rains and excessive humidity; in Europe it was battlefields pitted by shell holes and bomb craters as well as terrain which varied from flat farm country to rugged mountain regions.

From D-Day on, armies in the European theatre were often entirely dependent upon motor truck transportation. To keep the supplies flowing from beachheads to battlelines and to provide offensive mobility for forces in the field, a total of over 400,000 assembled motorized vehicles were landed in France. During the first World War slightly more than 49,000 motor vehicles reached the Continent.

Here are just a few representative accomplishments hung up by motor trucks in Europe:

Trucks of the 476th Quartermaster Corps traveled a grand total of 9,000,000 miles in transporting First Army troops, evacuating war prisoners and hauling supplies. The 460,000 tons of ammunition and material they moved was equivalent to the load carried by 46 Victory ships.

According to the Army Transportation Association, the bulk of the 3,000,000 long tons of supplies landed in France in the first 109 days after D-Day moved to its destination on rubber-shod wheels. The tonnage equalled 500 shiploads of 6,000 tons each, or 6,800 trainloads of 40 cars loaded with 11 tons per car, or the material which 1,000,000 two and a half ton cargo vehicles could haul.

American-made trucks provided the mobility for Russia's final drive to Berlin. During the period Lend-Lease was in effect, 362,000 vehicles went from automotive plants to the Red Army.

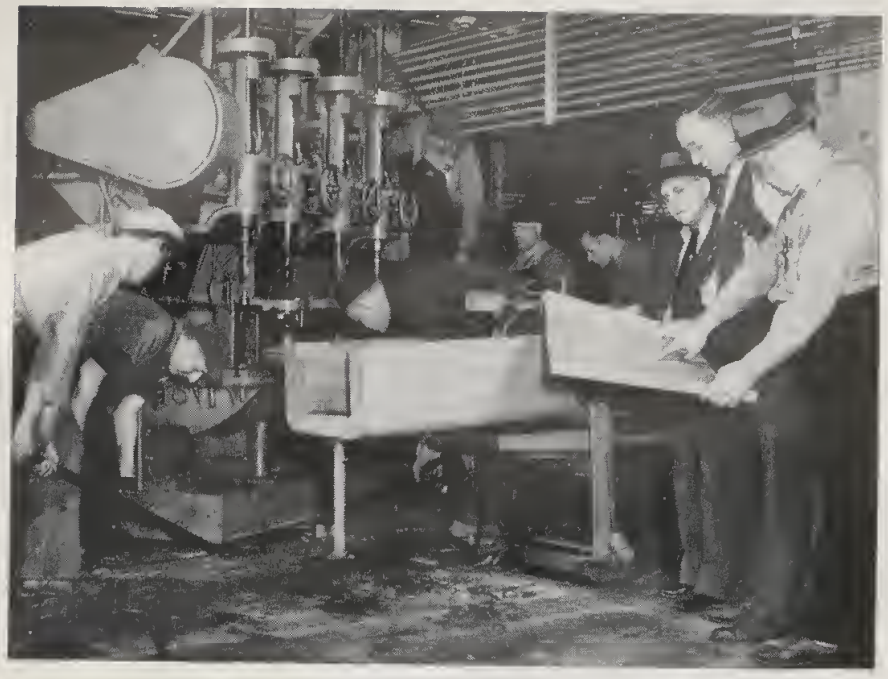
Similar reports for the Pacific Theatre of operations have not as yet been released by the armed forces. But nearly every atoll and island captured in the drive on Tokyo was quickly transformed into a transport link with modern highways.

One of the most spectacular feats performed in the Pacific area was the building of the Stilwell Road, formerly the Ledo Road. To accomplish the seemingly impossible job, hundreds of American-made trucks and units of road-building equipment were brought 16,000 miles to the wilds of Burma and China. At the time of the Japanese surrender, fleets of cargo trucks were beginning to pour supplies into the Chinese Army, traveling a 4,700-mile route which included the old Burma Road and the new Stilwell Highway.

On the home front, trucks won another notable battle of supply. Millions of war workers and civilians were fed and clothed through the work of motor carriers, while 54,000 communities—43 per cent of all the nation's communities—were sustained entirely by motor truck transportation.

The dependence of civilians in metropolitan areas, as well as those in uniform, on food carried by trucks is revealed in a recent survey which shows that last year 60 per cent of all livestock tonnage arriving at stockyards came by commercial motor vehicles. Among other commodities received in major distribution centers, trucks hauled 40 per cent of the fruits and vegetables, 26 per cent of the butter, 61 per cent of the milk, 52 per cent of the eggs and 34 per cent of the poultry.

In addition, the wartime operations of trucks transformed American highways into assembly lines hundreds of miles long. Raw materials were often funnelled by trucks into factories for fabrication, picked up and carried as finished components to other points for assembly as completed war goods, then hauled away and deposited on loading platforms for shipment to war zones.



Drill press to help produce civilian passenger cars is moved into place.

Advance Planning by Automotive Management Pays Off as Reconversion Hits Full Stride

THE American people already are reaping the rewards of preparatory planning for plant clearance and contract termination which the automotive industry initiated as long ago as 1943 and 1944 to guard against the possibility of an aftermath of seriously prolonged unemployment in the event of a sudden termination of the war.

Already employment has started to increase, following the lay-offs that resulted from the cancellation of war contracts after V-J Day. By the end of the year, employment in automotive plants should approximate that of pre-war years while by late spring it is predicted that more workers will be engaged in making cars and trucks than ever before in the industry's history.

This excellent progress in speeding reconversion is attributable to the initiative and drive of automotive management in impressing the military services and other government agencies with the seriousness of the dilemma the industry would be involved in were certain definite procedures not worked out ahead of time. As a result, methods to be used in clearing out government-owned machinery from plants were decided upon more than a year before the need arose. Contract termination procedures likewise were established and clarified, and paper work reduced to a minimum. Therefore, these twin knotty problems which existed a year or more ago, no longer are proving troublesome.

Further, the physical reconversion job is being done quickly because plans had been laid far in advance of actual need. Most companies knew well before V-J Day exactly how they would rearrange and rebuild their factories.

Still another favorable factor contributing directly and immediately to greater employment and production is that the industry had its plans fully made before V-J Day for the greatest expansion program undertaken in years. Some companies are stepping-up their capacity approximately fifty per cent. Others are enlarging so-called bottleneck departments to levels commensurate with the productive capacity of other departments, thereby increasing their production potential even more than 50 per cent. Fulfillment of these expansion programs indicates the confidence with which the industry is looking to the future.

From an employment standpoint, company officials believe the low point was passed Labor Day. Job opportunities now are mounting at an increasing pace as more and more workers are called back to aid in three major programs now going on simultaneously.

First, employment on actual reconversion tasks is mounting. Such work includes removal of government-owned machinery and installation of the most modern equipment available.

Second, many thousands of men are being utilized on expansion of manufacturing facilities. This involves tearing down old plants and building new and larger ones which also must be equipped with the latest and most efficient machinery.

Third, and proceeding side-by-side with the reconversion and expansion programs, many thousands of men and women already are making parts and sub-assemblies for cars that will not roll off the final assembly line until late October or November. Not generally realized is the important fact that 80 to 90 per cent of the labor expended to make an automobile is involved in manufacturing the parts and readying them for final assembly. Therefore, if the industry's expectation of high production by late this year is realized, employment should mount rapidly.

On the assumption that there will be reasonable cooperation between management, labor and government, industry sources expect that passenger car production will be running at about a 3,000,000 annual rate by the end of the year. By late spring, when most of the plant expansion now getting under way will have been completed, output should reach approximately a 6,000,000 annual rate. This would be about one-third greater than the industry did in 1929, its record year. It would be nearly double the average pre-war rate.

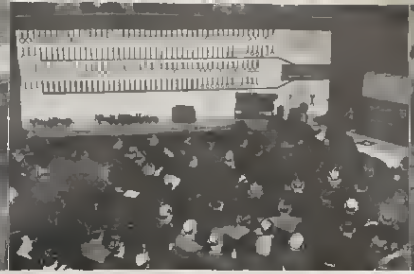
The importance to the national economy of the automotive industry's forward planning is highlighted by the fact that it not only is the largest industry in the United States but also before the war afforded jobs directly and indirectly to more than 6,500,000 persons. Its quick reconversion and expansion to productive levels far in excess of those possible before the war indicate how great a constructive force it can be in providing employment in the steel, textile, glass, rubber and other industries whose products are used in the manufacture of cars and trucks, and in that larger field of profitable occupation—the thousands of job opportunities embraced within "the service industries."

PICTURE CREDITS: Page 2—Signal Corps photo; Page 4—top row, number two, Acme Newpictures, Incorporated.

OCT. 15, 1940—Knudsen asks automotive manufacturers to produce $50E,00E,000 worth of aircraft parts.

OCT. 25, 1940—James Doolittle helped get automotive industry's bomber production program started.

DEC. 22, 1940—Exhibit of aircraft is set up by A.C.A.D. to enable automotive engineers to study new job.



JAN. 24, 1942—Magnitude of war job outlined at first meeting of Automotive Council for War Production.

FEB. 10, 1942—Last passenger car rolls from lines and conversion to armament manufacture is in high gear.

COOPERATION SPEEDED UP MUNITIONS FLOW

Automotive Council for War Production embraced 654 manufacturing firms, who voluntarily pooled production knowledge. Here's the wartime record and history.

WITH THE formal dissolution of the Automotive Council for War Production on October 1, 1945, an experiment unprecedented in U. S. industrial history is brought to a close almost exactly five years after it was conceived.

In the course of its brief life, the Council embraced a total of 654 manufacturing companies. Its membership represented the pooled mass-productive know-how of all of the nation's manufacturers of motor vehicles, in addition to most of the manufacturers of automobile bodies, trailers, automotive parts and accessories and the major producers of automotive tools and dies, jigs and fixtures, and special-purpose machinery.

It included big business and small business. In its working committees, officials of the world's largest corporations exchanged ideas with operators of little shops. It was the result of a grass-roots growth—a powerful co-operative, voluntarily formed by perhaps the world's most thoroughly indoctrinated believers in the intrinsic merits of free enterprise, personal responsibility, individual initiative, and competitive effort. It was a team whose form became the pattern for several other similar production teams, both here and abroad.

Created for the sole purpose of implementing the nation's defense with the total productive power of the automotive and related industries, the combination of industrial talent which it represented is estimated to have been responsible for at least one-quarter of the national output of weapons and materiel.

Finally, this concentration of vast potential power was voluntarily dispersed after serving its avowed purpose.

According to historical record, the Council was formed in the closing hours of December 31, 1941. Actually, however, its origins are traceable to an earlier time—to the cataclysmic summer of 1940, when William S. Knudsen, then recently summoned to Washington by the President to sit as a member of the National Defense Advisory Commission, was beginning the big job of evaluating the productive potential of American industry.

As the screaming urgencies of that historic summer followed one another in successive crises that expressed themselves in demands for more and more "billions for defense," Knudsen kept his focus fixed on the basic need—production, and yet more production. As national plans for increasing the dimensions of the armed forces expanded geometrically, Knudsen called upon more and ever more men of the automotive industry for help.

Master craftsmen in their own right, many of these men spent that summer learning the highly specialized arts of the armorer, the gunsmith, the shipwright and the aircraftsman, from other master-workmen, and sharing with their teachers their own equally specialized knowledge of mass-production.

Then, on October 15, 1940, Knudsen was invited to a meeting of the board of directors of the Automobile Manufacturers Association in New York. His former colleagues, friends and rivals in the automobile business, there assembled for what proved to be the last automobile show, had summoned him to honor him for his service to the nation.

Acknowledging the tribute, he asked them to suspend any future model changes that might require new machine tool purchases. They agreed to comply with his request and offered the toolmaking facilities of their own companies as additional resources.

That done, he astonished them with an additional request. Uttering stern words about the country's peril, he told them of the urgent need for tremendously expanded aircraft production, as that need had been described to him by military observers upon their recent return from an England then reeling under the blows of the German *Luftwaffe* and momentarily expecting invasion. He said he wanted them to undertake—cooperatively as an entire industry—the task of supplying a half billion dollars' worth of airplane parts, as sub-contractors to the overburdened aircraft industry.

"Tell us what you want us to do, we'll march to your orders," was their response.

A special meeting was suggested to organize a cooperative program in which all segments of the industry could participate, each company to contribute whatever it was best fitted for in lending assistance to the aircraft industry.

That meeting, held in a recently vacated grocery store in Detroit's New Center Building on October 25, 1940, was the genesis of the Council idea. It brought together for the first time the members of what subsequently became an inter-industry team for production of an unprecedentedly huge output of military aircraft.

The man who helped shape that team was General James H. Doolittle, then a major in the Army Air Corps. The team was called the Automotive Committee for Air Defense. Using rented floor space in an idle automobile plant for headquarters, it assembled an exhibit of bits and pieces of bombers from which automotive production engineers could pick and choose the items they felt their companies could produce.

So desperate was the nation's plight that the only aircraft parts available for this vitally necessary exhibit were discarded and rejected items salvaged from scrap piles.

Piece by piece, the displayed parts found their masters as more than 1,500 men trooped through the exhibit in the next few weeks. The first steps in building the world's mightiest air force were taken then and there.

Early in 1941, when ACAD had fulfilled its purpose, it was disbanded, and its former headquarters were converted into an Army Air Forces procurement center.

However, the seeds that had been planted here did not die. In the late summer of 1941, the industry undertook joint action in the form of organized interchange of technical information to insure maximum conservation of strategic materials required for arms production. Carried out through the Society of Automotive Engineers, the effort developed into the SAE's famous War Engineering Board, which put at the disposal of the armed forces the combined talents of the industry's best engineers and the pooled facilities of its research laboratories.

Then, a few hours after the Pearl Harbor attack, the lessons learned in the earlier cooperative effort were again remembered. The AMA directors, assembled in emergency session, agreed that industry-wide cooperation was required to enable the automotive industry to cope with the astronomically enlarged task confronting it. To be effective, they felt, the production team would have to include more than the thirty-odd members of the association. An invitation was therefore extended to all non-member companies in the industry to send representatives to another emergency meeting. By the end of December, the organizational activity embraced not only the vehicle, body and trailer manufacturers, but the automotive parts makers and the independent tool and die manufacturers.

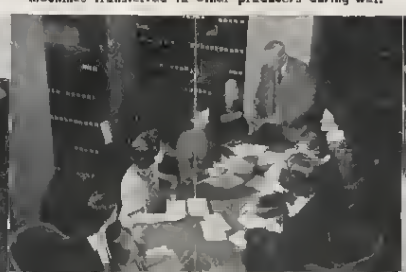
Thus, in the closing hours of 1941—perhaps the darkest hours in this nation's history—the Automotive Council for War Production was formally launched. An extremely flexible organization, democratic in form and easily adaptable to the unpredictable demands of a nation at war, it took over for the duration much of the staff and existing facilities of the AMA. (The latter organization continued in skeletonized form on a stand-by basis.)

Because it was a team of volunteers and, therefore, unhampered by hard and fast rules and regulations, it enabled the industry to solve speedily and effectively each and every bewildering problem that arose—and as it arose. Aircraft engines, airplanes of all kinds, guns and ammunition from small arms to heavy ordnance, combat ve-

(Continued on page 6)

JULY 10, 1942—W.P.B. chief, Donald M. Nelson, addresses automotive officials at meeting of A.C.W.P.

PLANS FOR PEACE—Government and industry meet to discuss what is needed for civilian manufacturing.



MACHINE TOOL LISTING SERVICE—9,000 automotive machines transferred to other producers during war.

PRODUCTION SECRETS UNVEILED—Engineers see how it is done in plant of former peacetime competitor.

PROBLEMS OF RECONVERSION—How to clear plants of government-owned material, equipment studied.

CENTRAL AIRCRAFT COUNCIL—Aircraft production problems were solved through this ACWP vehicle.

THE ARMED FORCES—Brought knotty problems to Council committees.

PRODUCTION FORUMS—In such gatherings Council members kept abreast of new developments.

(Continued from Page 5)

hicles in scores of varieties, naval equipment, delicate precision instruments of all kinds, and, in fact, all of the thousands of different kinds of products made by the industry for the armed services—all felt the impacts of such mutual helpfulness.

The virtue of the method was its flexibility, an attribute that stemmed from the simplicity of the standard operation. When a need arose—not infrequently, when someone sensed an approaching need—a committee was formed not for debate, but for action. If the problem was mastered, the committee was allowed to lapse into a stand-by capacity.

Early in 1942, when plant conversion and tooling of production lines were the ominous urgencies, solutions were quickly found by creating a clearing-house of information about existing needs and surpluses of machines and toolmaking facilities. The benefits of this action were felt far beyond the limits of the industry's normal boundaries: in all, more than 9,000 machines (enough to equip five automobile factories) were thus taken out of the industry in the first six months for use elsewhere.

Concurrently, production committees were formed. In them, men responsible for manufacturing similar products were grouped together to render mutual assistance to their respective companies. They met in the factories. Each month there was a different host, and the complexion of each group changed as new problems arose and new companies undertook work with which the veterans were familiar. In the plant of the host company, the guests were turned loose to examine methods, compare practices, swap ideas, make notes. New ideas were thus fanned out rapidly throughout the industry. Precious time was saved; in one instance, one company estimated a saving of nine months in getting into production of supercharged aircraft engines for the Navy. The total time thus saved is incalculable; being interested only in getting a job done well and quickly, the committee members neglected to record their accomplishments.

As the crisis-starred months of 1942, '43, '44, and '45 came and went, hundreds of unexpected problems reared their heads in ominous succession—and were mastered in succession. The steel shortage that threatened the whole war effort was anticipated by the formation of a salvage committee. It pooled information on best methods of plant housecleaning, turned up unexpectedly huge tonnages of scrap metals and rubber, and, as salvage procedures became automatic, subsided into inactivity.

When the flow of materials was dangerously fouled up, a committee of the industry's acknowledged experts in the related fields of purchasing and materials control was organized to lend assistance to Federal agencies. When manpower shortages threatened, the Council set up its manpower division composed of committees embracing in their membership the industry's recognized experts in the broad field of personnel relations.

As the tide of battle turned in favor of the United Nations, Council committees were formed to plan for the shocks which the nation's economy would have to sustain when the war ended. Plans were thus initiated as early as the fall of 1943 for the most expeditious methods for clearing factories of war work and for resumption of peacetime operations.

The list of accomplishments is endless. In many cases the work begun by committees was taken over by agencies of the armed forces, such as the Army Ordnance Department and the Army Air Forces. One such committee prepared the ground for a simplified method of standardized numbering and naming of replacement parts which expedited repair of ordnance in the field of action.

The pattern of voluntary cooperation was so demonstrably effective that, in the spring of 1942, it was copied by the aircraft manufacturers of the Pacific Coast. In the fall of that year, the manufacturers of aircraft on the Atlantic Coast followed suit. Later, at the recommendation of Army Air Forces' officers, a Central Aircraft Council was formed, as a division of the Automotive Council, by transfer to it of all committees that had been concerned with aircraft production.

The success of the pattern was also the subject of foreign investigation: British industrialists sent Oliver Lyttleton here to study it. Even the enemy detected its worth. On February 11, 1943, Dr. Albert Speer, taking over the German Ministry of Munitions and Armaments, issued this manifesto:

"Experience of arms factories must be pooled. I have ordered all war plants merged into rings so that every producer will obtain the benefit of the most efficient methods."

In announcing the Council's dissolution, Alvan Macauley, its president, said, "As to the accomplishments of this voluntarily cooperative effort, it is best to let the record speak for itself."

AUTOMOTIVE WAR PRODUCTION

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Plants' Service Flags Show 400,000 Stars

Many Veterans Back At Jobs as War Ends

APPROXIMATELY 400,000 men and women from automotive companies went into the armed services in the three and one-half years following Pearl Harbor.

A survey shows that the number of former automotive employes who had donned uniforms was equal to 23 per cent of the industry's employment rolls just prior to V-E and V-J Days.

At that time, roughly 15 per cent of the employes who laid aside work clothes and tools for uniforms and guns had been discharged from military duty. Of this number, about 10 per cent had applied for their old jobs and had been re-hired when final victory was announced.

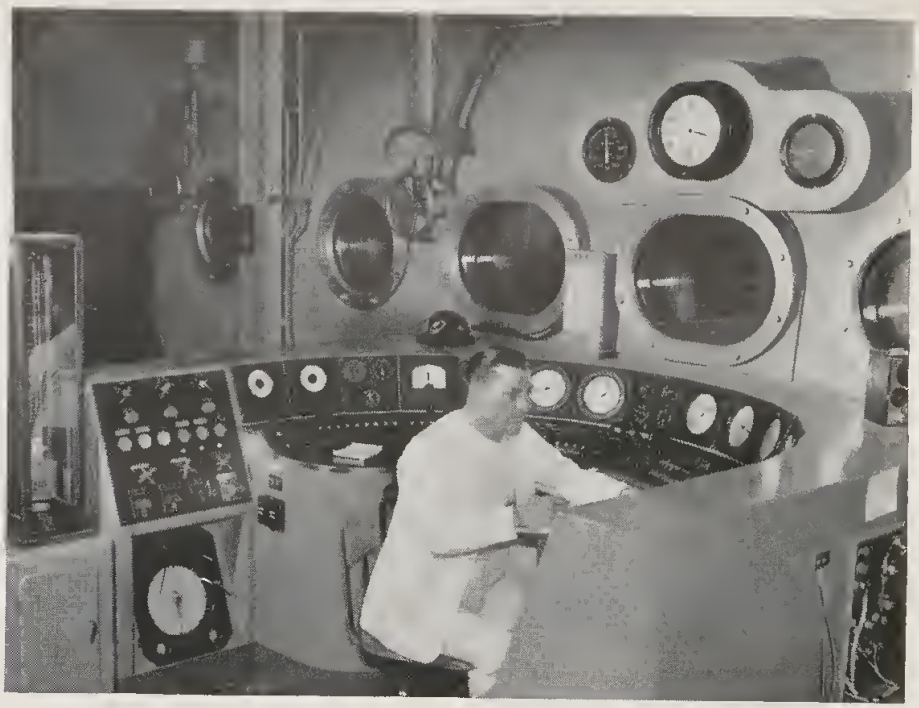
Analyzing the field of veteran re-employment, the survey points out that 36 per cent of those hired to date by automotive companies have a service incurred disability. Of veterans who returned to their pre-war occupations, 29 per cent were disabled in some degree; while, among those veterans hired who had no previous work record in the industry, 42 per cent possessed disabilities. The report cautions that while these figures may appear excessive, the great bulk of military discharges up to the present have been for medical reasons.

To Our Readers

WITH this issue, Automotive War Production, which you have received monthly since March, 1942, ceases publication.

When Japan went down to defeat, the automotive industry once again became a peace-time industry. Today the wartime assembly lines, which in slightly over three and one-half years turned out millions of units of fighting equipment, have ground to a halt. Machinery and facilities are now being rapidly converted to civilian pursuits and there are no more "Automotive War Production" facts to report.

A limited number of back copies of the publication are available to libraries and others interested in keeping a permanent record of the automotive industry's war years.



Research in the national interest is a continuing automotive industry project.

Task of Making Equipment for Atomic Bomb Undertaken by Automotive Manufacturer

THE atomic bombs which fell on Japan from B-29s early in August, a prelude to blasting the last Axis partner from the war, were the culmination of years of highly secretive, Herculean effort on the part of scientists from the United Nations, American industry and the military services.

Among the scores of major industrial concerns in every section of the country that supplied equipment for the revolutionary missile was an automotive company. This firm, whose exact contributions must necessarily remain secret, was asked to manufacture some $75,000,000 worth of equipment for the atomic bomb enterprise.

More than two and a half years ago its scientists, production men, layout specialists and technicians began the job of readying facilities for the components to be built. Around the premises of the plant used for the work, the project was officially known as "X-100." So much secrecy surrounded the job that only a few top officials of the motor company had an inkling of what was being undertaken.

The production planning for the new assignment spread over uncounted sleepless days and nights as automotive engineers wrestled with plant layout problems and with the tasks of designing apparatus to do the new and novel processing required. It included, also, the training of workers in new skills, to perform jobs whose purposes were not revealed.

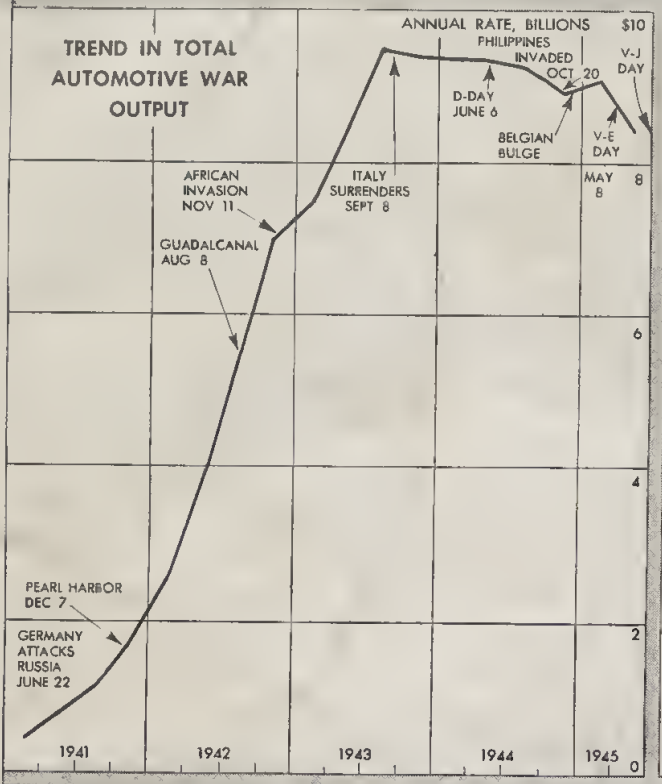
Although the end of the Japanese conflict meant that nearly all contracts held by the firm were immediately cancelled, as was true also in most other automotive companies, work on the atomic bomb will continue.

Similarly, certain other specialized projects are being carried on by several automotive companies. Most of these programs are in the fields of research and development of new equipment and engines for aircraft.

One automotive company, for example, has been asked to pursue an "advanced aircraft engine development program" by the Army Air Forces. Two plants have been acquired and equipped by the firm for experiments on jet propulsion units and gasoline turbine engines.

A second company is continuing to manufacture the intricate Air Position Indicator, the milk-bottle-size precision instrument which enables pilots and navigators to glance at a dial, much like an automobile speedometer in appearance, and immediately ascertain latitude and longitude.

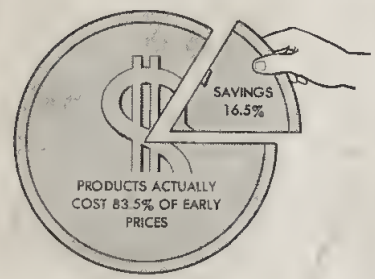
HIGHLIGHTS OF AUTOMOTIVE INDUSTRY'S WAR RECORD



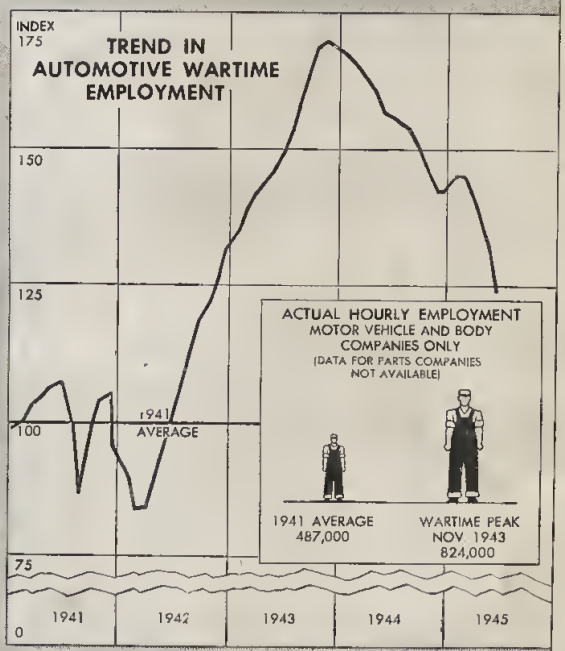
TOTAL OUTPUT BY CATEGORIES

AIRCRAFT AND PARTS	$11,245,000,000	38.8%
MILITARY VEHICLES AND PARTS	$8,591,000,000	29.7%
TANKS AND PARTS	$3,781,000,000	13.1%
MARINE EQUIPMENT	$1,952,000,000	6.7%
GUNS AND PARTS	$1,590,000,000	5.5%
AMMUNITION	$908,000,000	3.1%
ALL OTHER	$904,000,000	3.1%
TOTAL	$28,970,000,000	100%

SAVINGS TO TAXPAYERS



IF WAR PRODUCT PRICES HAD REMAINED UNCHANGED SINCE JANUARY 1, 1942, THE INDUSTRY DOLLAR OUTPUT WOULD HAVE REACHED ABOUT $32,100,000,000
HOWEVER, DUE TO PRICE REDUCTIONS, THE ACTUAL TOTAL DELIVERIES SINCE JANUARY 1, 1942, WERE $26,800,000,000
THUS, SAVINGS TO THE UNITED NATIONS AMOUNTED TO $5,300,000,000, OR 16.5%



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